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THE OAT VARIETIES OF NEW ZEALAND.

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DESPITE a reduction in the farm consumption of oats and oaten chaff following an increase in power farming, the oat still remains one of the three important arable crops of New Zealand. Its acreage is exceeded only by that of turnips, and its value equals, if it does not slightly exceed, that of wheat. Table 1 shows the position of the oat crop relative to that of wheat.

Table I.—Values and Acreages of Wheat and of Oats in New Zealand.

(Compiled from statistics issued by the Census and Statistics Office.)

VALUE IN MILLIONS OF POUNDS.

—	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.
Wheat ..	1·18	1·80	1·56	2·46	3·04	2·71	2·29	2·23	1·62	2·42
Oats ..	3·22	4·21	3·67	3·12	2·50	2·39	2·86	2·19	2·08	2·13

AREA IN THOUSANDS OF ACRES.

—	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.
Wheat ..	179	169	153	222	263	258	239	252	281	306
Oats ..	417	472	367	387	304	283	283	368	364	425

The importance of the crop is sufficient justification for this attempt to place on record the descriptions, distribution, utilization, and agronomic features of the more important varieties.

Much of the information offered has been collated from estimates submitted by Fields Superintendents and their staffs from every section of the country. Full acknowledgment is accorded them for their helpful co-operation. The type descriptions are the result of observations over two seasons by one of the authors (R. A. C.).

In 1932, through the courtesy of seed-merchants, a collection was made of about two hundred samples of seed oats from districts in which they had been harvested. These samples were grown primarily with the object of affording material from which varietal descriptions might be prepared, but they served also in revealing the general standard of the seed oats being offered in this country in respect to varietal purity and smut infection.

Varietal Purity and Smut Infection.

Observations made on these trials revealed the position recorded in Table 2.

Table 2.—Incidence of Varietal Impurities and Smut in Commercial Samples of Seed Oats from the 1931–32 Harvest.

(Trials conducted during the 1932–33 season.)

Variety.	Percentage of Impurities.	Percentage of Smutted Plants.
"Gartons"*	4·3	3·3
Algerian	0·4	1·2
Dun	0·5	3·4
Sparrowbill	12·5	0·4
Other varieties	4·3	5·4

* The use of the term "Gartons" is explained under the heading "Gartons Abundance."

It will be observed that the two varieties Algerian and Dun, which are commonly sown in the autumn, and are able to withstand heavy grazing during the autumn and winter, contain the lowest percentage of impurities. Algerian shows also a relatively low degree of smut infection, which fact lends credence to an impression held by many farmers that Algerian is less susceptible to this disease than are other commonly grown varieties.

The position is, however, far from satisfactory and calls for immediate steps in raising and distributing pure and smut-free seed. "Gartons"* alone represent 42 per cent. of the total acreage in oats, virtually the whole of which is harvested either for grain or chaff. A wastage of 4·3 per cent. due to smut on 42 per cent. of the oat crop valued at £2,000,000 is equivalent to an annual loss of £36,000.

Distribution of Varieties.

Rust is the most important factor governing the distribution of varieties. In the North Island Algerian, being rust-resistant, comprises 83 per cent. of the oats grown, and over most of this area is the only variety in general use that may be grown to maturity with any degree of success. It is preferred, even when grown primarily for green feed, on account of the possibility that circumstances may render it desirable to save the crop for chaff. On the other hand, in the cooler parts of Otago and Southland rust is not a serious consideration and "Gartons"* represent over 80 per cent. of the crop while Algerian is very rarely grown.

The variety of purposes for which the oat crop is used such as milling, feed oats, chaff, hay, ensilage and green feed, and the different soil and climatic conditions under which it is grown, might lead one to expect that a wide range of varieties, such as is available in other temperate climates, would be required to serve all purposes in this country. The varieties in use are, however, very limited, and their approximate distribution over New Zealand is shown in Table 3. The North and the South Island figures are given separately and the South Island is further divided on the basis of the two important and distinctive climates obtaining there.

Table 3.—Distribution of Oat Varieties in New Zealand, 1932–33.

District.	Acreage.	Percentage of Total Acreage represented by Varieties.			
		Algerian.	"Gartons."	Dun.	Other Varieties.
New Zealand	424,587	38	42	12	8
North Island	38,747	83	15·5	1·5	
South Island	385,840	33·4	45	13·2	8·4
Marlborough, Nelson, Canterbury, and North Otago	271,684	44	30·5	14·5	10
Mid and South Otago and Southland	102,804	0·3	80·6	12·6	6·5

It is not possible to say whether the varieties in general use are the most satisfactory from all points of view, since no systematic attempt has been made to determine the value in New Zealand of the many varieties available from other countries.

Utilization.

Returns compiled by the Census and Statistics Office divide the oat acreage into that harvested for grain, that for chaff, hay, or ensilage, and that not harvested but fed off as green feed. The information given in Table 4 is based on these returns.

Table 4.—Utilization of the Oat Crop in New Zealand, 1932–33.

District.	Total Area.	Threshed.	Chaff, Hay, and Ensilage.	Fed off and not harvested.
	Acres.	Per Cent.	Per Cent.	Per Cent.
New Zealand	424,587	27·4	61·1	11·5
North Island	38,747	9·3	71·3	19·4
South Island	385,840	29·2	60·0	10·8
Marlborough, Nelson, Canterbury, and North Otago	271,684	27·2	59·2	13·6
Mid and South Otago and Southland	102,804	36·2	59·9	3·9

In considering Table 4, it must be appreciated that, apart from the area used only for green feed, a very large proportion of the balance is autumn sown and grazed during the autumn and winter months. This is especially true of Algerian, but information of a more specific nature is given later under each variety.

Varietal Descriptions.

An attempt has been made to adopt standardized descriptions. While these have been made as simple as possible, it would seem nevertheless desirable to offer some prefatory comments.

The plants which formed the basis of these observations were spaced 8 in. by 6 in. apart. Such a characteristic therefore as tillering, which is modified by opportunity for development, must be regarded as

relative rather than actual. Under normal seeding and management tillering, for example, would be reduced far below the figures given. The observations do, nevertheless, afford useful relative comparisons.

Pretillering Stage.—This refers to that period subsequent to germination and prior to the development of potential panicle-bearing shoots. At this stage the herbage may present distinct forms of growth—*e.g.*, erect, semi-erect, prostrate. These are definite varietal characteristics, and the prostrate habit is associated with winter hardiness. This is a matter of no great significance in this country, except that varieties of this habit are usually those best able to withstand winter grazing and yet be capable of producing a satisfactory crop the following harvest.

Post-tillering Stage.—Tiller-production is the normal mode of branching commonly met with in cereals. Tillers arise at the base of the plant near the ground, and although tillers are the ear-bearing shoots, only a certain proportion of them finally produce panicles; thus arise the terms "fertile" and "infertile" tillers. Tiller-production may be regarded as an important varietal character, those producing abundant tillers being tolerant to autumn and winter grazing.

Panicle Emergence and Maturity.—In the two seasons during which these observations were made the plots were sown in the middle of August. Time of sowing has a direct influence on the period that elapses between germination and maturity and, owing to bird damage, the only possible basis for comparisons was panicle emergence. This may be regarded as a fairly reliable guide, although not as accurate as might be desired.

Leaf Characteristics.—At the date of initial panicle emergence the largest leaves were measured for length and breadth and in these descriptions are described as narrow, medium, and broad. The presence of hairs around the base of the leaf, and sometimes extending a short distance along the margin, serves a useful distinguishing feature.

The Panicle.—The term refers to the whole inflorescence, which is composed of a main axis or rachis from which arise numerous branches. These branches bear the spikelets within which the flower, and later the mature seed, is enclosed. The rachis is subdivided by nodes from which the branches arise. It may be straight or bent at the nodes. The branches occur in whorls. Their length and habit form useful means of varietal identification. When they arise at an angle of 45° or more to the main axis the panicle is termed "open." When almost directly ascending and closely adpressed to the axis the panicle is said to be "compact" or "closed." The panicle is said to be "equilateral" when the branches are balanced on each side of the axis, when directed to one side it is then "one sided."

The spikelets carry generally two flowers within the outer glumes and therefore two grains. The number is, however, variable.

The Grain.—This consists of a kernel enclosed within a husk and usually forms the simplest and most definite means of identification. The husk is composed of two separate structures, the flowering glume or lemma, and the pale, both of which are closely attached to, and completely surround, the kernel. When the grain is fully ripe these components develop a characteristic colour which is one of the most commonly used points for varietal differentiation. Although these colours are characteristic, they are not always well defined, being subject to modification under the influence of climatic conditions. Extending the length of the lemma may be observed what are known as "nerves," which may or may not be prominent. The awn, if present, is attached midway along the dorsal surface of the lemma and is in reality an elongation of the midrib of the lemma. It is usually confined to the lower grain of the spikelet and in some of the more highly developed varieties is much reduced in size or even absent. The long coarse twisted awn is an outstanding peculiarity of the wild oat. During threshing and cleaning processes the awns are removed and are seldom apparent in a dressed sample. Basal hairs arise around the base of the grain and generally accompany an extensive awn development—*e.g.*, wild oat and Algerian. They may be few, numerous, or absent, and when present may be long, short, coarse, or fine. Rachilla is the small stalk by which the upper grain is attached to the lower, and its length, colour, and hairiness may be used for purposes of identification.

The Varieties.

Appended are descriptions of the main botanical and agronomic characteristics of the varieties specified.

(1) Garton's Abundance.

(The description given may also be applied to the sample sent in under the name "Newmarket.")

The Plant.—Pretillering stage: Erect. Tiller development, low (10–11); ultimate panicle production, intermediate (5–6). Panicle emergence: Mid-season (115–120 days). Leaves: Broad, dark green, practically no appearance of hairs round base. Straw: Coarse, rather tall.

Panicle.—Long, erect, equilateral, open. Rachis: Straight. Branches: Long at an angle of 30°–45° or less to rachis. Spikelet: Two-grained, lower grain awned.

Grain.—Medium length, plump. Husk: Cream to white—nerves not prominent. Awns: Long, coarse, dark in colour, and twisted at base. Basal hairs absent. Rachilla: Medium length, fine, white, not hairy.

Garton's Abundance may be regarded as the standard white oat of New Zealand. So much so, in fact, that the name "Gartons" has become a trade term for all white oats, except those of distinctive character such as Sparrowbill. "Gartons A," and "Gartons B" are expressive of grades covering any ordinary white oat, and are quoted in that manner. The foundation of the "Gartons" trade oat is Garton's Abundance but includes also Record, Leader, Hero, and other varieties of secondary or very minor importance. There are now few pure crops of Record and Leader, although they appear as common impurities in Garton's Abundance. In these notes, therefore, the term "Gartons" is to be regarded as having reference primarily to Garton's Abundance, although other varieties are included.

"Gartons" probably represent 42 per cent. of the total acreage in oats in New Zealand made up in the North Island by 15·5 per cent., and in the South Island by 45 per cent. of their respective acreages. In the North, with the exception of a few hundred acres, the variety is confined to the Hawke's Bay and Wairarapa districts. In the South Island from North Otago northwards, probably 30·5 per cent. of the area is devoted to "Gartons" and southward 80·6 per cent. or more.

The use to which the variety is put may best be presented in tabular form as follows:—

Table 5.—Utilization of "Gartons" Oat in New Zealand.

District.	Acreage.	Grain.	Chaff, Hay, &c.	Fed off and not harvested.
		Per Cent.	Per Cent.	Per Cent.
New Zealand	149,438	40	52	8
North Island	4,925	14	36	50
South Island	144,513	42	53	5
Marlborough, Nelson, Canterbury, and North Otago	66,513	45	48	7
Mid and South Otago and Southland	77,400	38	58	4

It is evident from Table 5 that "Gartons" are used almost exclusively for grain and chaff, the 50 per cent. recorded in the North Island as being used for green feed representing actually a very small acreage. They cannot be used as readily as Algerian for winter grazing and still ensure the same prospects of a succeeding crop. The yield of chaff generally exceeds that of Algerian, but the quality is not regarded as being as good, owing to its rather coarse and leafy nature. This is particularly true of "Gartons" on heavy land, and under such circumstances a coarse, tangled crop often results from autumn sowing. In addition to its value as a feed oat the grain is used extensively for milling in the manufacture of oatmeal and proprietary cereal foods, the centre of this industry being in Southland.

(2) Algerian.

The Plant.—Pretillering stage: Prostrate. Tiller development: High (20–25). Ultimate panicle production: High (10–11). Panicle emergence: Early (95–100 days). Leaves: Rather narrow, medium green, base edges slightly hairy. Straw: fine, medium height.

Panicle.—Medium length, erect, equilateral, open. Rachis: Straight. Branches: Medium length, at an angle of 45° or greater, drooping at tip. Spikelet: Two-grained, both generally awned.

Grain.—Long, pointed, narrow. Husk: Light brown or dark yellow, nerves prominent. Awn: Long, fine, slightly twisted at base; that of the lower grain is more strongly developed than that of the upper one. Basal hairs: Prominent on lower grain; generally numerous, long, and rather coarse; not apparent in dressed samples. Rachilla: Medium length, fine, non-hairy; remains attached to upper grain.

Observations on the plots sown with samples of Algerian oats collected from merchants revealed the existence of distinct strains or types. A few of the commercial samples were relatively pure in respect to one or other of these strains, and their study is now being extended with progenies of single plant selections. In spring-sown plots at Palmerston North the differences were very marked during both seasons. While intermediate types did occur the extremes may be described as—

(1) Growth during pretillering stage relatively upright, mature plant tall, early and very productive.

(2) Pretillering growth prostrate, maturity late, plant very leafy, short, producing few heads and little grain.

When spring sown at Lincoln, Canterbury, these differences were scarcely observable, nor were they at all marked in autumn-sown plots at Palmerston North. It seems possible that further investigation will reveal the existence of winter and spring strains. The type description given above is on an intermediate type.

Australian Algerians have from time to time been sown in New Zealand and have given rise to queries owing to variations in time of maturity. In a communication Mr. Wenholz, Director of Plant Breeding in New South Wales, says, "The early strain of Algerians cannot be distinguished morphologically from the true strain; but, in addition to this, there are some crops in which the variety Belar and Algerian also appear to be mixed in some part of the State."

For many years the Canterbury Agricultural College has distributed an improved strain under the name of "College Algerian." In this selection particular attention was paid to its dual-purpose value,

affording satisfactory winter grazing in addition to grain and chaff. In the trial of commercial samples it was very evident that some of those marked "College" were misnamed, and others had been mixed since distribution had been effected by the College.

Rust-resistance is the most important feature which renders the Algerian oat of value in New Zealand. In the North and parts of the South Island where this disease is a limiting factor, virtually no other variety is grown. Even when grown for green feed Algerian is used in such districts, since there is always a possibility that the crop will be saved for chaff. Thus it comes about that 83 per cent. of the North Island acreage is in this variety, which includes the Wairarapa with 77 per cent. and Hawke's Bay with only 64 per cent.

Of the North Island acreage it is estimated that 23 per cent. is grazed only, 5 per cent. is harvested for grain, and the remaining 72 per cent. harvested for chaff, hay, or ensilage. When consideration is given to the fact that a fair proportion of the harvested crop is also grazed during winter, it is realized that the Algerian oat is of considerable importance as a supplementary forage crop.

In the South Island this variety represents about 43 per cent. of the Canterbury and North Otago crop. Further south than this it is rarely grown. In Canterbury and North Otago approximately one-third of the area is harvested for grain, one-third for chaff, and one-third for green feed only. Here, again, the bulk of the harvested crop affords supplementary feed during winter.

In Marlborough and Nelson probably 90 per cent. of the oat acreage is Algerian, of which 70 to 80 per cent. is cut for chaff and 15 to 20 per cent. cut for grain.

The ability of this variety to afford winter grazing and yet yield a satisfactory crop even under the most adverse conditions, coupled with its rust-resistance, are the two factors responsible for its popularity. The grain is used extensively as a feed oat, and the chaff is fine, sweet, and of good quality with very little leaf. In actual yield, however, it falls short of Garton's Abundance, more particularly when spring sown. Commercial lines of seed appear reasonably free from smut and are fairly pure, except for the occurrence of different strains about which little is known at present.

(3) Dun.

The Plant.—Pretillering stage: Prostrate. Tiller development: Very high (30–32). Ultimate panicle production: Very high (16–17). Panicle emergence: Mid-season (118–120 days). Leaves: Narrow, medium to dark green; base edges hairy; lowest leaf-sheath hairy. Straw: Fine, medium height.

Panicle.—Medium length to long; open, erect, equilateral. Rachis: Straight. Branches: Long, inclined at an angle of 45° or greater. Spikelet: Two-grained, lower grain generally awned.

Grain.—Rather long and narrow. Husk: Light to dark grey, nerves sometimes prominent. Awns: Long, dark, and slightly twisted at base. Basal hairs: Few and rather fine. Rachilla: Medium length to long; fine.

Approximately 12 per cent. of the New Zealand acreage consists of this variety, which is confined almost exclusively to the South Island. It is susceptible to rust, and crops are grown mostly in the higher

country or cooler localities. One main feature is its popularity as a feed for racehorses, largely on account, it is claimed, of a high proportion of oil in the seed. For this reason a dark colour in the seed is desired. The chaff is fine and of the highest quality. A second feature is its high tiller development, permitting winter grazing under severe climatic conditions and ability to produce a satisfactory crop of chaff the following summer.

(4) Green's Ruakura.

The Plant.—Pretillering stage: Semi-erect to erect. Tiller development: High (18–20). Ultimate panicle production: Very high (15–16). Panicle emergence: Early (90–95 days). Leaves: Narrow to medium width, edges and base hairy; lowest leaf-sheath hairy. Straw: Fine, medium height; nodes distinctly hairy above and below juncture.

Panicle.—Long, open, equilateral. Rachis: Straight. Branches: Long, at an angle of 45° or greater. Spikelet: Two to three grained, lower grain awned.

Grain.—Medium length, rather plump. Husk: Straw coloured to dark dun, nerves prominent. Awns: Long, coarse, twisted and dark at base. Basal hairs: Numerous, coarse, well developed. Rachilla: Short to medium length, rather stout; may be slightly hairy.

This variety is a selection from Argentina oat made in 1908 by Mr. A. W. Green, then at the Ruakura Farm of Instruction. The original head was one of over a thousand selections made from the varieties Algerian, Argentina, and Red Rust-proof with the specific object of attaining a high degree of rust-resistance. By 1914, 3,000 bushels of seed were available and sold at £1 per bushel. The name had until then been "Ruakura Rust-resistant," but owing to misunderstanding as to the difference between "rust-resistant" and "rust-proof," this was changed in 1914 to "Green's Ruakura." It proved to have far higher resistance to rust than Algerian and Red Rust-proof, and was for many years extremely popular in the North Island. Its distribution extended overseas, where its rust-resistance is well recognized and in certain places is still grown commercially. In New Zealand its use has virtually ceased. Mr. P. W. Smallfield, Fields Superintendent, at Auckland, reports that it was last grown at the Ruakura Farm in the 1923–24 season and that for a few years before that the yield was becoming progressively lower, so that a change-over was made to Algerian, and this variety has been grown ever since.

It is difficult to account for this deterioration. Apart from the fact that the straw is somewhat weak the Ruakura oat has grown remarkably well in plot trials at this Station and at the Pure Seed Station, Lincoln.

During the 1932–33 season the Canterbury (N.Z.) Seed Co., Ltd., grew on their property at Leeston, 14 acres of Ruakura oats. This was possibly the only area of this variety in New Zealand and had been raised by the firm from a handful of seed procured some years previously. Rust was extremely severe, so much so that Potato and Dun oats yielded only 27 bushels per acre, while the crop of 14 acres of Ruakura oats in the same paddock was not affected and yielded 114 bushels per acre.

Steps are now being taken to explore further the possibilities of the variety and to raise pure seed in the event of a demand forthcoming.

(5) Sparrowbill.

The Plant.—Pretillering stage: Erect. Tiller development: Intermediate (14–15). Ultimate panicle production: Intermediate (6–7). Panicle emergence: Late (124–126 days). Leaves: Medium width, medium green to dark green in colour; no hairs. Straw: Coarse, tall.

Panicle.—Long, equilateral, very compact. Rachis: Bent at and between nodes. Branches: Medium length, directly ascending and adpressed to rachis. Spikelet: One to two grained; no awns.

Grain.—Short and plump. Husk: White to creamy yellow, nerves not prominent. Awns absent. Basal hairs: Rare or absent. Rachilla: Medium length, fine, white, non-hairy.

The cultivation of this variety is confined almost exclusively to Mid and South Otago and parts of Southland. At one time it was

SPARROWBILL. HERO. SIR DOUGLAS HAIG. BLACK SUPREME. BLACK TARTAR.

grown fairly extensively, but now probably not more than 4,000 acres are sown, representing about 1 per cent. of the New Zealand acreage.

The grain is of value for milling and is also used as poultry-feed, and there is a small demand for seed of this variety for growing as green feed in the North Island.

(6) Record.

(The description may also be applied to sample sent in under name of White Winter.)

The Plant.—Pretillering stage: Erect. Tiller development: Very low (9–10). Ultimate panicle production: Very low (3–4). Panicle emergence: Mid-season (115–120 days). Leaves: Medium width, medium to dark green; a few hairs round base of leaf. Straw: Coarse, rather tall.

Panicle.—Long, equilateral, compact. Rachis: Generally bent at nodes. Branches: Long, directly ascending and adpressed to rachis. Spikelet: One to two grained; only an occasional awn on lower grain.

Grain.—Rather long, plump. Husk: Light yellow, nerves not prominent. Awns: Long, dark, and slightly twisted at base. Basal hairs absent. Rachilla: Medium to long, fine; non-hairy.

A few crops of Record are still grown, but in the main it has been replaced by Garton's Abundance. The comments under the latter variety apply equally to Record, the seed of both being regarded in the trade as "Gartons." Record is included in the tables as "Gartons."

(7) Hero.

The Plant.—Pretillering stage: Erect. Tiller development: Low (11–12). Ultimate panicle production: Very low (3–4). Panicle emergence: Mid-season (115–120 days). Leaves: Medium width, dark green. No hairs. Straw: Coarse, rather tall.

Panicle.—Long, one-sided, compact. Rachis: Bent slightly at nodes. Branches: Long, directly ascending and closely adpressed to rachis. Spikelet: Two-grained with only an occasional awn on lower grain.

Grain.—Medium length, rather plump. Husk: White or light yellow, nerves not prominent. Awns: Long, dark, and twisted at base. Basal hairs absent. Rachilla: Medium length, medium thickness.

This variety is similar in many respects to Record and White Winter and is classed as a "Garton," and included in the tables under this heading. Pure crops are still grown, but in the main the variety is being replaced by Garton's Abundance.

(8) Sir Douglas Haig.

The Plant.—Pretillering stage: Erect. Tiller development: Very low (8–9). Ultimate panicle production: Very low (3–4). Panicle emergence: Mid-season (115–120 days). Leaves: Very broad, pronounced droop towards tip; a few hairs around base. Straw: Coarse, rather tall.

Panicle.—Long, one-sided, compact. Rachis: Bent slightly at lower nodes. Branches: Long, directly ascending and closely adpressed to rachis. Spikelet: Two, three, or four grained; an occasional awn on lowest grain.

Grain.—Rather long and narrow. Husk: Yellowish to dark brown, nerves prominent. Awns: Medium length, fine, pale, twisted slightly at base. Basal hairs may or may not be present. Hairs may generally be observed on the lemma immediately below and bordering the base of the awn. Rachilla: Long, fine, that attached to the lower grain being hairy. Rachilla of upper grains may be considerably elongated, projecting them beyond the tip of the spikelet.

A variety of distinct possibility, but so far is reported only in Marlborough where it is recognized as of value for green feed.

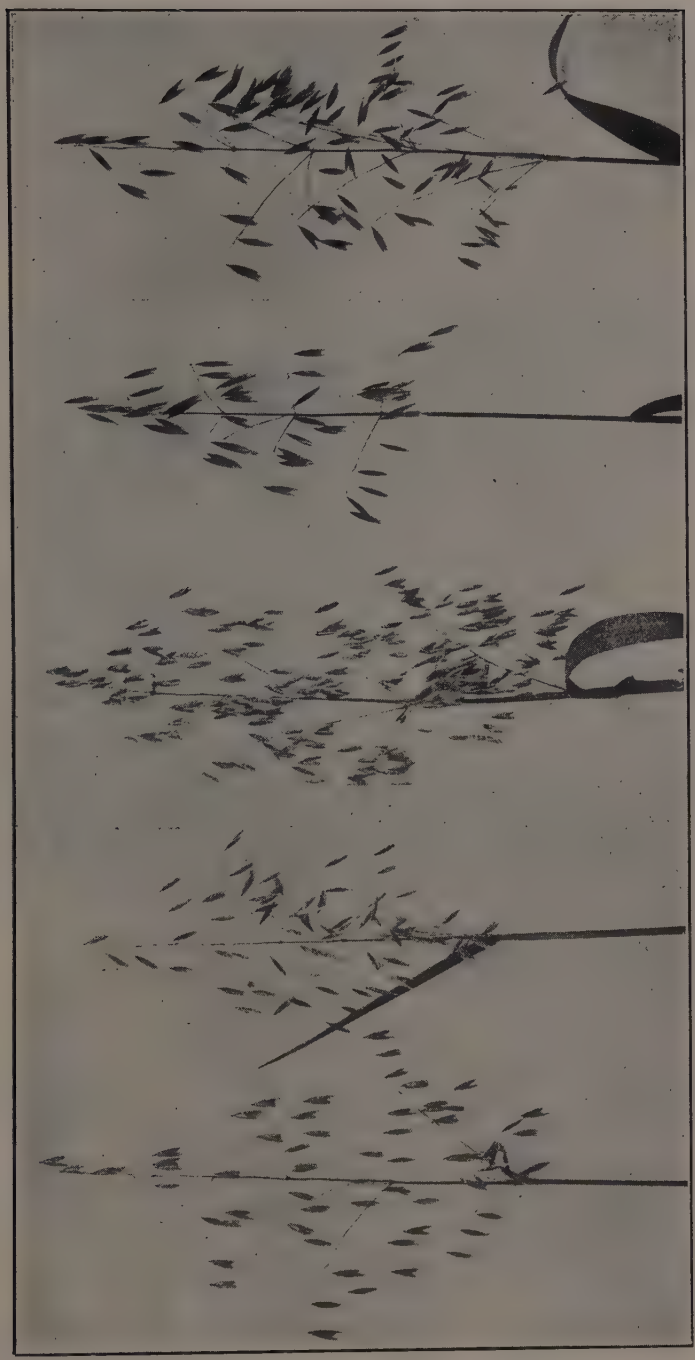
(9) Black Tartar.

The Plant.—Pretillering stage: Erect. Tiller development: Intermediate (12–14). Ultimate panicle production: Low (4–5). Panicle emergence: Late (120–125 days). Leaves: Medium width; medium to dark green. No hairs. Straw: Coarse, rather tall.

Panicle.—Medium length; one-sided, narrow, and compact. Rachis: Distinctly bent at and slightly curved between nodes. Branches: Medium length and closely adpressed to rachis. Spikelet: Two-grained; an occasional awn on lower grain.

Grain.—Rather long and plump. Husk: Black to dark brown, nerves not prominent. Awns: Short to medium length, fine, not twisted at base. Basal hairs: Not numerous, short and fine. Rachilla: Medium length to long, fine, light brown in colour.

Probably somewhere in the vicinity of 1,000 to 1,500 acres are grown annually in Otago and Southland, and is a variety particularly adapted for high country.


RUAKURA.
ALGERIAN.
ABUNDANCE.
WEBB'S CHALLENGE.
DUN.

(10) Webb's Challenge.

(The following description may also be applied to samples sent in under the names of "Black Prolific," "Black Scotch," and "Black Excelsior.")

The Plant.—Pretillering stage: Prostrate to semi-erect. Tiller development: Very high (30–31). Ultimate panicle production: High (10–11). Panicle emergence: Mid-season (118–120 days). Leaves: Narrow to medium width; medium to dark green with a greyish tinge; base and edge quite hairy; lowest leaf-sheath hairy. Straw: Fine, medium height.

Panicle.—Long, erect, equilateral, open. Rachis: Waved slightly at and between nodes. Branches: Long, at an angle of 45° or less. Spikelet: Two-grained, lower grain generally awned.

ALGERIAN STRAINS.

On the left is a tall, early, and productive strain; in the centre an intermediate form; and on the right a late strain which is extremely unproductive when autumn-sown at this Station. The sheaves are the actual produce from adjoining plots of equal size.

Grain.—Long, rather plump. Husk: Dark mahogany to black in colour, nerves not prominent. Awn: Long, dark, and twisted at base. Basal hairs: Numerous and coarse. Hairs also may generally be observed on the lemma immediately below and bordering the base of the awn. Rachilla: Long, fine, hairy.

Distribution of this variety is mainly confined to Otago and Southland, and it is estimated to occupy from 1,000 to 1,500 acres annually.

(11) Black Supreme.

(The description may also be applied to the sample sent in as "Black Superior.")

The Plant.—Pretillering stage: Erect. Tiller development: Low (10–12). Ultimate panicle production: Very low (3–4). Panicle emergence: Mid-season (116–118 days). Leaves: Broad, medium to dark green; base and edges hairy; lowest leaf-sheath hairy. Straw: Coarse, rather tall.

Panicle.—Short to medium length, one-sided, dense, compact. Rachis: Bent at nodes. Branches: Medium length, directly ascending and closely adpressed to rachis. Spikelet: Two-grained, lower grain occasionally awned.

Grain.—Short to medium length, plump. Husk: Black to dark brown, nerves not prominent. Awns: Medium length, dark, and slightly twisted at base. Basal hairs absent. Rachilla: Medium length, rather stout.

FIELD TRIALS WITH "CERESAN NEW" SEED DUST.

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DURING the 1933–34 season a series of eighty-one trials of the organic mercury seed dust "Ceresan New" was carried out on field crops of oats, barley, wheat, and peas in the chief cropping-areas of the Dominion. The trials were made possible by the co-operation of the Crop Experimentalist's section and of the staff of the Fields Division.

The method of trial consisted in the dusting, by the Instructors in Agriculture in the various districts, of one or more bags of seed for sowing in a defined area in the same paddock as the balance of the seed which had been subjected to the farmer's usual treatment. The dusting, at the rate of 1½ oz. to the bushel, was carried out in small portable machines, kindly loaned by Bayer Products, Ltd., the makers of "Ceresan New." No attempt was made to measure any differences in the results, but each trial was visited at least once by the Instructors concerned and the visual results recorded. These records are collected in the following table:—

Seed-treatment with which "Ceresan New" Dust is compared.	Number of Trials.	Braird.			Crop.			Smut.		
		Better.	Worse.	Equal.	Better.	Worse.	Equal.	Better.	Worse.	Equal.
OATS.										
No treatment ..	19	4	1	14	2	1	16	7	0	12
Formalin	10	3	0	7	0	0	10	0	0	10
Bluestone ..	5	4	0	1	3	0	2	1	0	4
Clarke's Protector ..	5	2	0	3	0	0	5	3	0	2
BARLEY.										
No treatment ..	2	1	0	1	1	0	1	..	..	..
Formalin	4	2	0	2	0	0	4	..	..	..
Bluestone ..	2	1	0	1	0	0	2	..	..	..
Clarke's Protector ..	3	0	0	3	0	0	3	..	..	..
Copper carbonate ..	3	2	0	1	0	0	3	..	..	..
WHEAT.										
No treatment ..	1	1	0	0	0	0	1	..	..	..
Formalin	3	1	0	2	1	0	2	..	..	..
Bluestone ..	6	5	0	1	3	0	3	..	..	..
Clarke's Protector ..	2	2	0	0	2	0	0	..	..	..
Copper carbonate ..	10	4	0	6	1	0	9	..	..	..
PEAS.										
No treatment ..	6	0	0	6	0	0	6	..	..	..

Explanation of Table.

The columns headed "Braird" refer to the appearance of the crop at or within a few weeks of germination. Where a difference was noted as a rule the Instructors stated that the germination of the "Ceresan-New" dusted seed was from two to six days earlier than the farmer's treated seed, that the stand appeared to be thicker, and that the plants were a darker green in colour. It is perhaps significant that in most of these cases the crop had actually been inspected by the Instructor at this stage, whereas where no difference was recorded the crop had been visited only at maturity.

Under the heading "Crop" are tabulated observations at or near harvest. Where a difference was noted, the comment was usually "earlier and thicker," though in one trial with oats the reverse was recorded.

Under the heading "Smut" are tabulated observations on both loose and covered smut of oats, covered smut of barley, and stinking smut of wheat. Of the 28 trials on oats recorded in the table as "equal," 16 showed no smut in the paddock. No smut was recorded in any of the trials of barley or wheat.

Summary of Results.

Out of 39 observational field trials of the effect of "Ceresan New" seed dust on oats, 13 showed a superiority in speed and vigour of germination over the farmer's own treatment, 1 was recorded as inferior, and 25 as showing no difference. At maturity 5 were recorded as superior, 1 as inferior, and 33 showed no difference.

Less smut occurred on the "Ceresan-New"-treated seed than the farmer's treated in 11 trials, 6 showed no difference, and in 22 no smut was recorded in either.

In 14 similar trials with barley, 6 showed an improved germination and early growth, while in 8 no difference was recorded. At maturity 1 trial was recorded as showing an apparently heavier yield from the "Ceresan-New"-treated seed, 13 showed no difference. No records were obtained on the relative effect of the treatments on covered smut.

With wheat in 22 trials, 13 showed a definite superiority for the "Ceresan-New"-dusted seed in the early crop stages, 9 showed no difference. At maturity 7 showed promise of a better yield, 14 showed no difference. No stinking smut was recorded in any of the trials.

On field peas in 6 trials of the effect of "Ceresan New" no differences could be detected between the dusted and undusted seed.

Discussion of Results.

The method adopted in these experiments with "Ceresan New" seed dust was designed to record only visible outstanding differences between it and other seed treatments in use on the farms. No attempt was made to obtain the exact measurements necessary for the detection of small differences in germination, yield, or disease control. Nor was there a constant method employed in making the observations—some of the experiments being visited and observed on several

occasions, others only once. No allowance has been made for the higher rate of seeding with dusted seed as compared with that treated by the various wet methods when sown with the same setting of the drill. Allowing for these weaknesses in the evidence, it is apparent that, in many cases at any rate, cereal seed dusted with "Ceresan New" showed better field germination than similar seed either untreated or treated by other commonly employed methods. In regard to its effect on the crop at harvest, the evidence is not so positive, but differences, unless of considerable magnitude, are difficult to detect at this stage. In regard to smut-control, comparisons were only possible with oats, and on this cereal the "Ceresan New" dust treatment showed at least as efficient control of the disease as either of the three wet treatments with which it was compared.*

* For fuller comparisons between the various common seed-treatments for the control of cereal smuts see articles in this *Journal*, March, April, 1934.

STATISTICAL INFORMATION RELATING TO THE DAIRYING INDUSTRY.

THE appended information, prepared under the authority of the Prime Minister, was presented to the Dairy Industry Conference held in Wellington on March last.

1.—Total Dairy Cows in Milk and Dry, and Estimated Production per Cow.

Season.	Cows.	Production per Cow.	Season.	Cows.	Production per Cow.
		lb.			lb.
1923–24 ..	1,312,589	174·10	1928–29 ..	1,371,063	210·84
1924–25 ..	1,323,432	182·09	1929–30 ..	1,441,410	218·05
1925–26 ..	1,303,856	179·40	1930–31 ..	1,601,633	201·05
1926–27 ..	1,303,225	198·50	1931–32 ..	1,702,070	199·65
1927–28 ..	1,352,398	195·38	1932–33 ..	1,845,972	215·10

2.—Cows milked, Total and Average Production per Cow milked.

Season.	Cows milked.	Total Production.	Production per Cow (nearest Pound).
		lb.	
1929–30	1,390,000	314,000,000	226
1930–31	1,500,000	322,000,000	215
1931–32	1,582,000	340,000,000	215
1932–33	1,724,000	397,000,000	230
1933–34	1,815,000*	435,000,000*	240*

* Estimated.

The Probable Herd Position for 1934–35 Milking Season.

Statements are often heard to the effect that heavy slaughterings of dairy cows this autumn will tend to stabilize the milking-herd for 1934–35, and that this in itself will tend to restrict production. Cow population can be studied over the period 1931–1933 from actual figures, and these give some indication of the possible movement in cow numbers next year. The position may be stated as follows :—

Milking Season 1931–1932.—Total cows = 1,702,070. This herd was derived from 346,156 replacement heifers plus 1,601,633 cows from the previous season, less deaths and killings. Killings of cows for the season amounted to 126,884.

Milking Season 1932–33.—Total cows = 1,845,972. This herd was derived from 370,697 calves enumerated in 1931, which gave 365,357 replacement heifers, plus 1,702,070 cows from the previous season, less deaths and killings. Killings of cows for the season amounted to 151,997.

Milking Season 1933–34.—Estimated total cows this season in milk or dry = 1,950,000. This herd was derived from 360,697 calves enumerated in 1932, which gave 359,697 replacement heifers, plus 1,845,972 cows from the previous season, less deaths and killings. Killings of cows for the season amounted to 199,678.

Milking Season 1934–35.—380,244 calves enumerated in 1933 should give 377,000 replacement heifers for the 1934–35 herd. These, plus the 1,950,000 estimated herd for 1933–34, less deaths and killings, will represent the 1934–35 milking-herd. Deaths amount to approximately 70,000 per annum. Therefore, if 307,000 cows are slaughtered between January, 1934, and January, 1935, the herd would remain at the 1933–34 level. Any killings less than 307,000 will result in an increase in herd. It should be noted that killings of cows have been on the increase each year, the largest number being 199,678 in 1933.

For the purposes of this computation, " cows killed " are assumed to be dairy cows.

3.—Utilization of Total Estimated Butterfat Production in the Dominion.

Season.	Butterfat for Butter.	Butterfat for Cheese (including Whey Butter).	Butterfat in Milk consumed.	Butterfat in Cream consumed.	Butterfat for other Dairy-products.	Butterfat in Milk fed to Calves and in Milk and Cream spilt and wasted.	Total Butterfat produced.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1923–24	145,802,150	63,780,243	11,470,742	1,418,566	1,474,766	4,570,336	228,516,803
1924–25	160,090,656	61,020,707	11,704,612	1,447,488	1,902,311	4,819,711	240,985,575
1925–26	149,932,385	64,083,464	11,967,905	1,480,049	1,770,993	4,678,261	233,913,057
1926–27	171,329,058	66,579,951	12,209,829	1,509,967	1,890,384	5,173,861	258,693,050
1927–28	177,580,362	65,553,951	12,385,219	1,531,658	1,900,715	5,284,733	264,236,638
1928–29	191,983,119	75,391,935	12,529,237	1,549,468	1,835,348	5,781,410	289,070,517
1929–30	219,334,751	72,304,066	12,688,458	1,569,159	1,890,361	6,281,363	314,068,158
1930–31	223,733,816	75,478,174	12,863,258	1,590,776	1,900,000	6,440,123	322,006,147
1931–32	237,385,977	79,631,084	12,998,445	1,607,494	1,397,837	6,796,344	339,817,181
1932–33	282,003,967	90,877,774	13,099,374	1,619,976	1,526,242	7,941,374	397,068,707

4.—Gross Butter Imports to the United Kingdom, Calendar Years 1924–33 (in Thousands of Tons).

(From *Trade and Navigation of the United Kingdom.*)

Year.	Denmark.	New Zealand.	Australia.	Russia.	Irish Free State.	Argentina.	Sweden.	Finland.	Netherlands	All Others.	Total.
1924	86·7	54·3	32·5	14·1	23·1	26·9	2·9	6·7	4·6	12·8	264·6
1925	82·9	62·8	58·1	14·6	20·1	24·2	4·1	8·5	3·8	13·6	292·7
1926	95·3	57·7	37·6	13·2	24·8	25·7	7·7	9·3	7·5	12·1	290·9
1927	99·8	63·0	24·4	17·5	29·3	21·0	8·3	10·3	8·5	9·2	291·3
1928	100·8	61·4	43·6	16·8	27·9	18·2	8·8	9·9	6·5	11·9	306·0
1929	110·2	65·7	38·4	14·5	28·3	15·1	12·4	11·7	6·5	17·5	320·3
1930	115·9	78·5	47·5	8·2	26·0	20·7	13·9	11·6	4·9	14·2	341·4
1931	123·3	96·8	77·9	20·2	19·0	18·7	10·6	12·7	4·8	19·5	403·5
1932	129·2	111·2	89·8	16·2	15·7	19·5	8·8	10·8	2·3	18·9	422·4
1933	126·0	125·6	84·7	28·1	18·9	10·1	11·3	6·7	7·3	23·0	441·7

5.—Gross Cheese Imports to the United Kingdom, Calendar Years 1924–33 (in Thousands of Tons).

(From *Trade and Navigation of the United Kingdom.*)

Year.	New Zealand.	Canada.	Nether-lands.	Italy.	Australia.	All Others.	Total.
1924 ..	74·0	50·3	7·2	6·9	2·3	3·7	144·4
1925 ..	69·6	62·7	7·1	8·1	4·0	3·6	155·1
1926 ..	74·9	52·8	9·4	7·1	2·3	4·1	150·6
1927 ..	80·6	42·2	11·4	7·1	1·8	4·4	147·5
1928 ..	77·8	46·0	11·4	7·1	3·7	4·3	150·3
1929 ..	90·0	36·2	9·8	6·6	2·5	4·6	149·7
1930 ..	98·0	33·9	9·2	7·2	2·4	4·9	155·6
1931 ..	86·6	35·3	8·4	6·6	3·4	3·9	144·2
1932 ..	92·6	37·4	8·5	5·3	3·7	2·8	150·3
1933 ..	102·0	31·5	6·1	4·5	4·5	2·3	150·9

6.—Gross Monthly Butter Imports to the United Kingdom from New Zealand, Australia, Denmark, and other Countries, in Thousands of Tons.

——	New Zealand.	Aus-tralia.	Den-mark.	Others.	Total.	New Zealand.	Aus-tralia.	Den-mark.	Others.	Total.
	1932.					1933.				
January	12·8	9·2	8·7	4·9	35·6	12·7	12·0	8·7	3·9	37·3
February	10·4	11·6	9·0	5·4	36·4	9·5	9·2	8·6	4·0	31·3
March ..	12·9	8·9	7·3	3·7	32·8	13·9	11·7	10·0	5·8	41·4
April ..	9·3	5·6	9·1	6·0	30·0	11·0	9·4	11·2	6·6	38·2
May ..	8·7	5·9	12·8	7·4	34·8	8·7	8·7	11·9	9·0	38·3
June ..	7·1	6·1	14·3	11·7	39·2	12·8	4·0	13·3	12·6	42·7
July ..	7·4	4·4	13·4	15·0	40·2	6·3	2·3	12·2	15·8	36·6
August ..	5·1	5·7	13·0	10·8	34·6	11·3	2·2	10·8	16·6	40·9
September	7·7	4·5	11·0	11·8	35·0	7·9	1·6	11·2	11·4	32·1
October ..	3·1	5·4	10·7	8·8	28·0	7·6	3·5	9·7	9·2	30·0
November	11·3	8·5	10·1	3·8	33·7	11·4	6·5	8·9	5·2	32·0
December	15·4	14·0	9·8	3·0	42·2	12·5	13·6	9·5	5·3	40·9

7. Average Monthly Quotations for New Zealand and Danish Butter (in Shillings per Hundredweight).

(From Dairy Control Board Cables.)

Month.	New Zealand.	Danish.	New Zealand.	Danish.
	1932.		*1933.*	
January	97·0–100·0	124·0–125·2	80·5– 81·7	109·0–111·0
February	104·5–106·7	141·5–143·0	76·0– 78·5	107·0–107·2
March	108·0–110·0	125·0–126·5	72·2– 74·6	95·2– 97·6
April	104·2–106·8	116·0–116·8	66·7– 68·7	93·2– 94·0
May	95·0– 97·0	103·5–104·2	76·2– 78·2	92·0– 93·5
June	95·5– 97·5	100·5–101·7	78·4– 80·6	89·6– 90·8
July	102·6–104·2	110·8–112·4	78·5– 80·0	94·5– 96·5
August	106·5–109·2	111·5–113·2	87·5– 89·5	102·7–103·7
September ..	109·6–113·8	121·8–123·6	98·4–101·8	112·4–113·6
October	101·0–110·2	118·0–119·0	94·7– 99·0	111·2–112·2
November ..	89·7– 95·5	121·5–123·0	81·7– 86·2	118·2–118·5
December ..	82·8– 84·6	121·2–122·4	67·8– 69·8	109·2–110·2

8. Payout for Butterfat received at Butter, Cheese, and Dual Factories.

(From New Zealand Factory Production.)

Season.	Pence per lb.	Total Payout £ (N.Z. Currency).	Season.	Pence per lb.	Total Payout £ (N.Z. Currency).
1919–20 ..	20·77	9,312,959	1927–28 ..	17·99	17,306,433
1920–21 ..	28·10	14,671,660	1928–29 ..	18·48	19,597,810
1921–22 ..	14·45	10,129,221	1929–30 ..	16·25	19,145,717
1922–23 ..	17·18	14,376,656	1930–31 ..	11·58	14,023,477
1923–24 ..	15·57	13,929,235	1931–32 ..	11·03	13,971,280
1924–25 ..	16·90	14,901,634	1932–33 ..	8·93	13,485,246
1925–26 ..	18·21	15,490,121	1933–34 ..	8·00*	13,375,000*
1926–27 ..	15·38	14,345,782			

* Estimated.

9.—World Production of Margarine (Tons).

	1930.	1931.	1932.
United States of America ..	140,000	102,658	90,667
Holland	110,000	90,000	80,000
Great Britain	220,000	228,000	195,000
Germany	480,000	450,000	440,000
Denmark	80,000	79,000	75,000
Norway	50,000	48,000	45,000
France	40,000	40,000	32,000
Sweden	55,000	51,000	50,000

These figures are according to Frank Fehr and Co.'s "Oilseed Review for 1932."

10.—Consumption of Margarine in United Kingdom.

——	1924.	1931.	1932.	1933.
	Tons.	Tons.	Tons.	Tons.
Imports	65,767	34,665	4,619	1,626
Home manufacture* ..	183,175	193,000	191,000	177,000
	248,942	227,665	195,619	178,626
Less exports	2,141	10,025	3,913	1,737
	246,801	217,640	191,706	176,889
	lb.	lb.	lb.	lb.
Consumption per head ..	12·35	10·55	9·3	8·5

* Estimated, but considered reliable.

NOTE.—In both Holland and Germany severe restrictions have been imposed upon the margarine trade—in Holland by the compulsory incorporation of a minimum quantity of butter (40 per cent. at present) and in Germany by regulation of production per factory plus a heavy tax. Denmark has also imposed a heavy tax on margarine.

11.—Consumption of Butter in United Kingdom.

	1924.	1931.	1932.	1933.
	Tons.	Tons.	Tons.	Tons.
Imports	264,638	403,558	418,218	441,726
Home make	40,000	40,000	40,000	40,000
	304,638	443,558	458,218	481,726
Re-exports	9,553	17,572	15,272	4,285
	295,085	425,986	442,946	477,441
	lb.	lb.	lb.	lb.
Consumption per head ..	14·76	20·66	21·48	23·16
Total butter and margarine consumed per head	lb. 27·11	lb. 31·21	lb. 30·78	lb. 31·66

12. DAIRYING IN GREAT BRITAIN AND MILK MARKETING SCHEME.

(*a*) *The Extent of Dairying in Great Britain.*

Dairying is, next to meat, the most important branch of the British agricultural industry. Out of a total consumption of dairy produce valued at £113,000,000 some £59,000,000 is produced locally in Great Britain. The corresponding figures for meat show a local production of £69,000,000 out of a total consumption figure of £155,000,000.

The following tables appearing on page 199 of the Report of the Reorganization Commission for Milk gives an estimate of the total quantity of milk produced in Great Britain and how it is marketed or utilized :—

(*b*) *Estimate of Utilization of Milk-supply of Great Britain in 1924–25 and 1930–31.*

Channel of Utilization.	Quantity.		Fresh Milk Equivalent.		Fresh Milk Equivalent as Percentage of Total.	
	1924–25.	1930–31.	1924–25.	1930–31.	1924–25.	1930–31.
Liquid milk—	Mil. gals.	Mil. gals.	Mil. gals.	Mil. gals.	Per Cent.	Per Cent.
Consumed on farms	108·6	73·0	108·6	73·0	8·4	5·1
Consumed off farms	787·8	873·9	787·8	873·9	61·2	61·3
Total ..	896·4	946·9	896·4	946·9	69·6	66·4
Butter—	Cwt.	Cwt.				
Made on farms ..	621,000	702,800	164·1	185·6	12·7	13·0
Made off farms ..	52,000	94,400	13·7	24·9	1·1	1·8
Total ..	673,000	797,200	177·8	210·5	13·8	14·8

(*b*) *Estimate of Utilization of Milk-supply of Great Britain in 1924-25 and 1930-31*—continued.

Channel of Utilization.	Quantity.		Fresh Milk Equivalent.		Fresh Milk Equivalent as Percentage of Total.	
	1924–25.	1930–31.	1924–25.	1930–31.	1924–25.	1930–31.
Cheese—	Cwt.	Cwt.	Mil. gals	Mil. gals.	Per Cent.	Per Cent.
Made on farms ..	647,500	689,800	72·7	77·4	5·6	5·4
Made off farms ..	214,000	532,000	24·0	59·7	1·9	4·2
Total ..	861,500	1,221,800	96·7	137·1	7·5	9·6
Cream—	Gals.	Gals.				
Sold by farmers ..	856,000	1,714,000	10·5	21·1	0·8	1·5
Sold by others ..	2,280,000	1,806,000	30·9	24·6	2·4	1·7
Total ..	3,136,000	3,520,000	41·4	45·7	3·2	3·2
	Cwt.	Cwt.				
Condensed milk ..	783,000	893,800	21·3	24·3	1·7	1·7
Milk-powder ..	123,000	139,700	9·6	11·0	0·7	0·8
Other milk-products	77,000	35,600	6·5	3·0	0·5	0·2
Estimate for unrecorded firms	..	..	..	4·0	..	0·3
Wasted	..	..	38·3	43·0	3·0	3·0
Grand totals ..	..	..	1,288·0	1,425·5	100·0	100·0

(*c*) *The Average Annual Gross Imports of Milk and Milk-products from British and Foreign Countries, and the Average Annual Net Imports from all Sources, and the Milk Equivalents of these Imports, for the Years 1929–31.*

Product.	Gross Imports.						Net Imports.	
	British Countries.		Foreign Countries.		Total.		Total.	
	Quantity.	Milk Equivalent.	Quantity.	Milk Equivalent.	Quantity.	Milk Equivalent.	Quantity.	Milk Equivalent.
	000 Cwt.	Mil. gals.	000 Cwt.	Mil. gals.	000 Cwt.	Mil. gals.	000 Cwt.	Mil. gals.
Fresh milk	59	0·64	4	0·04	63	0·68	63	0·68
Cheese	2,602	291·94	395	44·32	2,997	336·26	2,967	332·90
Condensed milk, whole ..	42	1·14	627	17·06	669	18·20	663	18·03
Milk-powder, sweetened	13	1·02	..	..	13	1·02	13	1·02
Butter	3,238	855·16	3,855	1,018·10	7,093	1,873·26	6,877	1,816·22
Cream (Irish)	74	11·18	..	..	74	11·18	73	11·02
Cream (other)	..	..	77	5·24	77	5·24	76	5·17
Preserved milk, other kinds (half-cream)	0·5	0·04	3·6	0·31	4·1	0·35	3·5	0·30
Total of whole milk equivalent	..	1,161·12	..	1,085·07	..	2,246·19	..	2,185·34
Condensed milk, separated or skimmed	60	1·93	1,955	62·75	2,015	64·68	2,104	67·54
Milk-powder, unsweetened	141	16·72	148	17·55	289	34·27	273	32·38
Total of skimmed milk equivalent	..	18·65	..	80·30	..	98·95	..	99·92

The above table is taken from Report of the Reorganization Commission for Milk, Ministry of Agriculture and Fisheries, Econ. Series No. 38, page 215.

DIVERSIFICATION AS A MEANS OF MAKING DAIRYING SAFER AND MORE PROFITABLE.

1. POTENTIALITIES IN FAT-LAMB PRODUCTION ON PORTIONS OF SOME DAIRY-FARMS.

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DIVERSIFICATION SUGGESTED BY EXPERIENCE.

FREQUENTLY history intelligently interpreted in relation to current circumstances is of value as a source of guidance, and, in view of the national concern that the difficulties of the dairy industry of the Dominion are now causing, certain facts of the history of the agriculture of important tracts of both the old and the new world seem to point to the advisability of considering the merits of diversified or mixed farming in comparison with those of specialized or one-crop (including one class of stock) farming.

While the maintenance or improvement of soil fertility, which is one of the principal advantages of mixed-farming systems in regions devoted dominantly to annual arable crops, is of relatively little moment in regions in which grass farming is dominant, yet experience shows that associated with diversified farming there are other substantial advantages which promise to be of importance in the position which it is generally expected the dairy industry will have to face in the immediate future. History shows that periods of marked price fluctuations, such as have followed great wars, overproduction, succession of adverse seasons, &c., have almost always brought about distress to specialized or one-crop farming regions. Diversification on the other hand has tended to assure a uniformily better living by giving greater independence of market variations and price fluctuations which often affect one product more than others. Incidentally, diversification alone is far from being the key to universal continuous prosperity; it is well known that some farmers do not obtain success even under the most favourable circumstances. But it has been demonstrated that much can be expected from the combination of appropriate diversification with efficient farm practice and reasonable industry and thrift.

It is interesting to note the present degree of diversification in Danish farming, which until about the "seventies" or "eighties" of last century was essentially a system of corn-growing. The general position in Denmark, the farming-area of which is approximately one-sixth the occupied area of New Zealand, is indicated by the fact that in 1928 Danish farmers derived income(7) from 1,579,000 dairy cows, 5,350,000 slaughtered pigs, 23,000,000 poultry, and 85,000 acres devoted to specialized seed-production. According to Faber(1) the area devoted to seed-culture in 1907 was less than 10,600 acres. The corresponding position in New Zealand is indicated by the fact that at 1st January, 1933, the number of dairy cows, including dry cows, was 1,845,000, the number of pigs slaughtered for the year was 624,000, and the number of poultry, when the figures were last obtained in 1926, was 3,800,000.

Briefly, the position is that in relatively modern times many farming regions have passed through various stages of development of a nature

which seems to carry a lesson to our dairying industry. As the pioneers usually had to obtain their living largely on the farm they usually produced a diversity of crops and stock. When transportation facilities improved the crop most easily and profitably grown as a rule became a specialty, and often was grown exclusively. Later, for different reasons under different circumstances, this special crop began to fail, and a change to diversified farming became necessary. The diversified era of farming became a more permanent and relatively prosperous development. The question of practical current moment is whether diversification can be employed successfully to alleviate enduringly the dairying industry of New Zealand.

Possible Scope for Fat-lamb Production in Dairying.

A type of diversification which has been proposed is the utilization of some of the grassland of a certain proportion of our dairy-farms for fat-lamb production instead of for butterfat production. Whether the replacement of dairy cows by breeding-ewes would prove sound farm economy is governed by several matters, among which the following are of basic importance: (1) The relative feed requirements of the two classes of stock; (2) the relative returns from the two types of production; (3) the labour position which arises from carrying the two classes of stock on the one property.

THE RELATIVE FEED REQUIREMENTS.

Though it is at times considered that good dairying pastures are to some extent necessarily unsatisfactory for sheep, it seems likely that this belief often is based not on fact but on confused thought: at times it would seem that it is not the pasture itself but the grazing management of the pasture which brings about comparatively unsatisfactory results with sheep on pastures of accepted good dairying type. In some support of this view is the fact that in respect to nutrition the requirements of the dairy cow and the breeding-ewe are essentially the same—both require feed which is highly digestible, rich in proteins required for milk and flesh production, and rich in mineral compounds containing phosphates and lime which are required for milk and bone production. In further support of the same view is the fact that successful sheep-farming has been carried out for years on land adjacent to and similar to that on which from 250 lb. to 300 lb. of butterfat an acre has been produced.

The fact that the feed requirements of the dairy cow and of the breeding-ewe are essentially the same warns against the danger involved in having these two classes of stock competing on the same pastures for feed which tends at all to be in scant supply, and points to the advisability of making butterfat production and fat-lamb production completely self-contained ventures even when they are carried out on the same farm. While it is not necessarily impossible to have these two types of production carried out concurrently with success on the same pastures, it is well to realize there is an inherent danger in having cows and ewes attempting to share satisfactorily the same feed-supply.

THE RELATIVE RETURNS AND LABOUR REQUIREMENTS.

A question of primary importance is how the rent or interest charges that could be borne by a dairy-farm would be affected if portion of the farm were devoted to fat-lamb production. The returns and the labour

costs which largely determine the rent that could be paid are governed so much by management that general statements are of little value. But what can be achieved in a specific instance by really good pasture management has been demonstrated on the farm of Mr. Phillips at Marton, where the main feature is fat-lamb production.

Method and Results of Special Grazing Management on a Marton Sheep-farm.

Probably the most important management factor which is chiefly responsible for the remarkably high carrying-capacity of this property, when compared with that of the majority of other farms in the same district, is the manipulation of stock. The area of the farm is 100 acres, and in every respect the land is typical of a large surrounding district. From an original carrying-capacity of between three to four breeding-ewes per acre, which is substantially that of similar land in the surrounding district to-day, the system evolved by Mr. Phillips over the past seven years has enabled him to winter and lamb eight and three-quarter breeding-ewes per acre during the past season, and it is the considered opinion of the owner that the maximum has not yet been reached.

A most intensive form of rotational grazing is practised by concentrating the whole flock in one paddock and shifting daily, and for this purpose the 100 acres is subdivided into fourteen paddocks averaging approximately 7 acres each. Till lambing commences the 870 breeding-ewes receive a fresh paddock each morning. As a consequence each paddock provides one day's grazing and is then allowed thirteen days to recover. So far the remarkable increase in carrying-capacity has resulted without the provision of any arable supplementary crop being produced on the farm. During the past three seasons one 7-acre paddock has been saved for hay, but the owner asserts that there appeared to be no great need for this, as sufficient grass growth was always in evidence. Last spring, for the first time, 22 tons of mangels were purchased and fed over a period of six weeks to the flock of 870 breeding-ewes: this provided less than 1½ lb. of mangels per head daily. The daily shifting is carried out without the aid of dogs, and the owner explains that the sheep soon become familiar with the daily routine, and all that is necessary is to stand at the open gate and regulate the movement of the mob to avoid crushing. All paddocks are taken in regular turn, and driving through one paddock to reach another is avoided. When lambing commences Mr. Phillips's usual procedure is varied, and is contrary to the customary practice on most sheep-farms. Each morning as lambs begin to appear the ewes not yet lambed pass on as usual to the fresh paddock leaving behind all ewes which have lambed so that the freshly lambed ewes remain a day longer in the same paddock. Next morning a further number of lambed ewes stay behind while the main flock passes on to another fresh paddock. The first lot of ewes and lambs are now joined up with the second lot, and this system is followed until a flock of from eighty to a hundred lambed ewes is collected. Then this small flock also begins to have daily shifts to fresh paddocks, and as further additions are gradually made to this flock the number in the flock not yet lambed correspondingly decrease. Eventually two flocks of ewes and lambs are formed, and each continues to receive its daily shift. About this time grass-growth is sufficiently vigorous to allow

FIG. 1. A GENERAL VIEW OF THE EWE FLOCK IN A 7-ACRE FIELD.

FIG. 2. A PASTURE THE DAY AFTER GRAZING.
The pasture is not as fouled as might be expected.

recovery to take place by spelling for intervals of a week. Growth continues to increase, but the young lambs soon begin to assist in controlling it, and so the pastures are kept short and leafy.

No dogs are used when shifting takes place, and the sheep are naturally very quiet in consequence. The lambing consistently has been in the vicinity of 100 per cent., and the total loss last season was sixteen lambs. The loss in ewes throughout the whole season last year was heavier than usual, and amounted to less than 4 per cent. The sale dockets examined indicated that 470 lambs, showing weights of from 31 lb. to 33¾ lb., were drafted to the freezing-works before Christmas, followed by a further draft in February, and the tail end in March. The return for lambs worked out at slightly over £1 per head. The ewes clipped over 8 lb. per head in the past season, and the wool realized 11d. per pound at the second Wanganui sale.

The practice of buying full-mouthed ewes each season is generally followed, and lambing is timed to commence in August. Earlier lambing is not favoured. Water is gravitated over the farm from a large concrete tank, and each pair of paddocks is served with a concrete trough.

The manuring programme is to top-dress annually with 4 cwt. of artificial fertilizer per acre in the autumn, and within the last few years lime has been regularly applied.

At time of writing — mid-April — there are on the property 920 breeding-ewes in lamb which the owner proposes to carry through the coming winter, and in addition there are 130 cull ewes and 200 lambs being fattened on grass. (The fat-buyer has since taken drafts.)

The total sheep on this 100-acre farm in April was 1,250.

Discussion of Methods and Results.

The grazing management followed by Mr. Phillips is, in its fundamental features, a successful adaptation to sheep-farming of the method of grazing management which has been giving outstanding results in dairying. In one instance which has been recorded(2) the butterfat production was increased in one year from 159 lb. to 216 lb. an acre without any material additional outlay or change in the herd. Further, at Marton Experimental Area, with sheep grazed on pastures comparable to those on Mr. Phillips's property, a carrying-capacity at least equivalent to that achieved by Mr. Phillips was readily obtained(3).

The essential features of this type of grazing management are—(*a*) intermittent grazing and spelling of each field; (*b*) the periods of spelling are of relatively short duration and consequently the grazing periods are correspondingly short; (*c*) really close grazing is not carried out. Stock are removed from a field when there is still much fresh growth on it.

Mr. Phillips's practice of restricting the grazing periods to one day's duration is an essential feature of the system. One of the objections commonly raised to periodical changing of breeding-ewes from one paddock to another between lambing-time and the sale or weaning of their lambs is that the change in feed which the change in paddock almost always brings about is detrimental to the progress of the lambs. This undoubtedly is a well-founded objection if any substantial change

FIG. 3. A CLOSE-UP VIEW OF A PASTURE READY TO BE GRAZED.
Rich in vigorous rye-grass and clover.

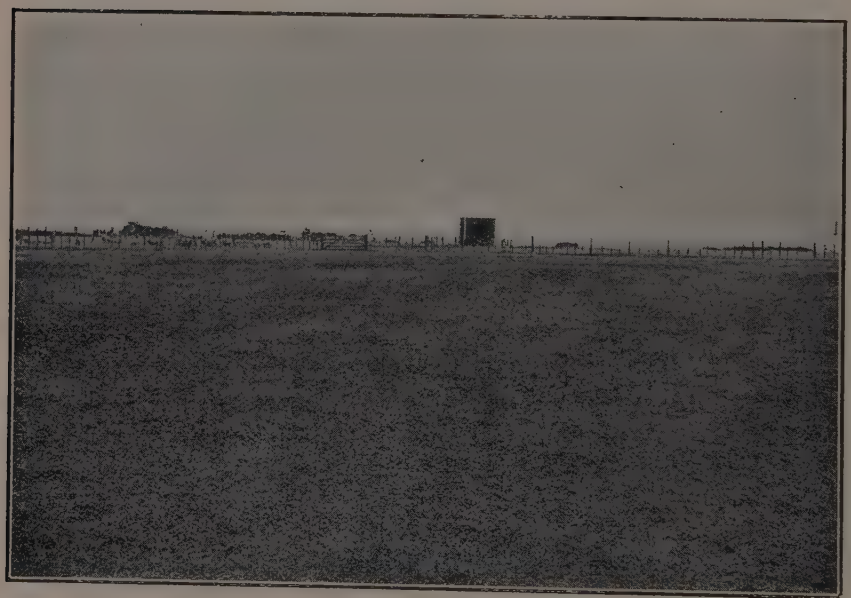

FIG. 4. THE CONCRETE TANK FROM WHICH WATER IS DISTRIBUTED TO EVERY FIELD ON THE FARM.

in feed occurs, but the system described above results in the sheep having access daily to a fresh supply of young, leafy pasture, so that actually throughout the whole season the character of their feed is as uniform as it is practicable to make it under any system of grazing. Long periods of spelling, though possible, are not desirable in dairying. With sheep they would be impracticable in spring and summer, as they would result in the feed getting beyond the stage of growth at which it is suitable for sheep. Under Mr. Phillips's system the fields are grazed during much of spring and summer at intervals of from six to seven days.

The fact that the system does not entail hard grazing is of much moment. Firstly, it minimizes the injury which is caused by the defoliation of the pasture plants(4),(5). Consequently it lessens the period occupied in recovery and return to the stage of relatively rapid rate of growth. This provides a partial explanation of the increased carrying-capacity under the system. Secondly, it means that the sheep are not punished in respect to feed in the manner necessary to effect really hard grazing.

The system practised by Mr. Phillips obviates to a substantial extent both the overgrazing in winter and the undergrazing in spring and summer which in many farms either is not obviated or is obviated to some extent only by the seasonal grazing of additional stock—usually cattle. It has been established that grazing management which leads to overgrazing in the winter and undergrazing in the spring and summer results in a deterioration in the botanical composition of the sward(6). The avoidance of this deterioration probably assists in begetting the increased carrying-capacity possible under the system.

A disadvantage believed to attach to the periodical changing of ewes and young lambs from paddock to paddock is that necessarily it would bring about "mis-mothering." The results of the practice described above have demonstrated that "mis-mothering" can be avoided. The sheep soon become accustomed, as soon as the gate is opened, to pass of their own accord from one field to the next. Only experience will show whether sheep will pass as readily from larger paddocks—say, ones of from 25 acres to 50 acres—as they do from the ones of 7 acres. If they do, then the size of paddocks is immaterial: it will be necessary to have only about fourteen paddocks irrespective of whether the area devoted to sheep be 100 acres, 300 acres, or 600 acres.

The top-dressing carried out by Mr. Phillips is an important factor in the attainment of a carrying-capacity exceptionally high for his conditions. But it is considered to be by no means such a dominant factor as is his method of manipulating the grazing of the sheep. Further, enrichment of the supplies of plant-food materials may be attributed not only to the applications of lime and artificial fertilizers but also to the animal excreta to which may be attributed a considerable amount of the vigorous growth of the pastures, especially in the colder seasons in which growth normally is relatively dormant.

Mr. Phillips utilizes pastures which in respect to composition and vigour would prove eminently suitable for dairying. This is of some significance relative to the possibility of fat-lamb production being carried out instead of butterfat production on portions of some dairy-farms. Important aspects of this matter are—(1) The method of grazing management carried out by Mr. Phillips would be practicable

only when the flock of ewes and the herd of cows operated at any one period as separate units, each grazing exclusively its own pastures. (2) Only experience will show the minimum size of paddocks that can be grazed successfully by sheep under this method. It is believed tentatively that paddocks less than 4 acres in area might not prove economically successful, partly because overhead charges in respect to provision of water and to subdivision become greater per acre as the size of the paddock decreases. If this belief proves well-founded, then the area of the minimum portion of a dairy-farm that could be diverted to fat-lamb production under this method would approximate 50 acres, and so the application of the method would be restricted to relatively large dairy-farms—ones so large that, having been reduced 50 acres or more in area, they would still support a dairy herd of economic size. Further, the portion devoted to fat-lamb production should be in one block of such a shape that the ewes can be transferred directly from paddock to paddock. The application of the method to farms devoted essentially to fat-lamb production is also worthy of consideration.

It is not known that Mr. Phillips's method as herein described is the best possible one for his or for any other circumstances: only exhaustive and extended investigation which has not been carried out would provide definite knowledge on this point. Nor, even in the light of the imperfect present knowledge, is it considered to be necessarily the method which should be followed generally in all details. This description of the method has been given merely to indicate to others what one farmer is doing; it remains for other farmers to consider carefully the potentialities of the method relative to their own conditions.

About the method two positive statements can be made with assurance: (1) Over several consecutive years the method has given Mr. Phillips exceptionally good results. (2) In the light of modern grassland knowledge it is fundamentally sound as a means to vigorous pastures of heavy yields of highly nutritious feed.

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(4) Jones and Jones: *Welsh Plant Breeding Station, Series H*, No. 11.
(5) Woodman, Norman, and French: *Jour. of Agric. Sci.*, Vol. 21, Pt. 2.
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INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 8th March to 22nd March, 1934, include the following of agricultural interest:—

No. 70034: Hay-sweep; H. R. Saunders. No. 70324: Mixing manures; C. C. Selwood. No. 69288: Emulsifying dairy-products; C. Doering and H. H. Doering. No. 70050 and No. 70099: Hay-sweep; H. R. Saunders. No. 70119: Spout for milk-bottle; R. R. Mason. No. 70531: Milk-cooler; O. A. White. No. 70577: Forcing powder into rabbit-burrow; F. W. and C. H. Bycroft. No. 70601: Packing fruit; W. H. Cassell and F. E. Dahn. No. 70615: Cattle-drenching apparatus; E. F. Murphy. No. 70703: Releaser; S. Oldfield. No. 71158: Moth destroying; V. Leggo and Farmers Ltd. No. 71211: Wheat-treatment: J. A. S. Marris. No. 71509: Dehorner; E. T. Mercer.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

PAMPAS GRASS AS WINTER COW-FEED.

B. C. ASTON, Chief Chemist, Department of Agriculture.

IN this *Journal* for October, 1932, was given some account of the successful utilization of the tall South American plume grass known as pampas grass (*Gynerium (Cortaderia) argenteum*), universally grown as an ornament in gardens where it produces tall dense tussocks which, including the flowering stalk and plume, attain a height of 10 ft. to 12 ft. When grown in gardens the mass of material produced in the course of years presents a bulk of herbage which would not impress any one, least of all a dairy-farmer, as being likely to prove an attractive feed for cows, the persistent dead leaves of the tussock mixed with the tall coarse leaves showing a dry innutritious-looking mass. When, however, dead or old leaves are prevented from accumulating by firing every year after cattle have eaten down the succulent green portions and some of the dead leaves also the subsequent growth is tender and easily grazed by cows. Knowing that this material grows at the rate of a foot a month and produces per acre 50 tons of green edible matter of higher dry-matter content than turnips or mangels, that it will be greedily eaten by cows in the winter, that it cannot spoil with bad weather (drought, heavy rains, or gales), that it requires no weeding, no cultivation, and no fertilizer and hardly any attention after once planting, the rapid growth of green succulent leaves is impressive in the extreme. The clumps will grow on any kind of soil and, when possible, throw down roots to a depth of 8 ft. below the surface, which enables the giant tussock to search over a large area for the plant food and water which it requires. One can easily imagine the average dairy-farmer being sceptical as to the good news and looking for the catch in the system which in the Northern lands, at least, does away to some extent with the laborious hay and silage making and root-growing. The method is being thoroughly tested by independent farmers in the Waikato and Mr. McClean is distributing roots of the grass as far south as Wellington. Arrangements are being made to test the use of this grass on the pumice lands where it grows vigorously and where it can have such a good root-run in that deep permeable soil.

In spite of the sometimes pathetic attempts of cattle to get at pampas and devour it, these attempts have been disregarded as evidence that it might be desirable to cultivate it for food purposes; in spite also of the advice of two eminent men—Sir George Grey and Dr. Curle—who seemed to anticipate its future value. One observer tells how cows will lie down on their sides in an endeavour to get their heads under the bottom wire of a fence to eat the pampas, often destroying fences in their attempts to get at this favourite fodder. When this happened the farmer merely strengthened his fences, shutting his eyes to the value of such evidence. One farmer, Mr. George Short, of Dargaville, writes that twenty-two years ago he had his first experience of pampas, and since then he has always grown it for shelter and stock-food, for in winter all stock are fond of it, breaking down good fences to get at it. He has grown it on drain banks, in paddocks, and on hill land. It grows as well on poor gum land as it does on good swamp land. It would be a great asset to exposed farms near the coast where other shelter cannot thrive

owing to salt winds. Mr. Short has not grown it for fodder alone, but knows its value as stock-food. He sends photos of hedges he planted at Turiwiri, Northern Wairoa, one of the oldest of which is six years old and 10 ft. high and shows signs of being well grazed as far as cattle can reach (see Fig. 1).

To Mr. Alec McClean, of Waitakaruru, Hauraki Plains, must, however be given the great credit of being the first to profit adequately from his observations that cattle are inordinately fond of pampas in the autumn, by systematically planting and using it as winter feed as described in the previous article. Since then, Mr. McClean has extended his plantations and has continued to use pampas systematically as winter food and has answered all inquiries which have come from both local and overseas farmers. He has willingly received and explained to deputations of agriculturists, chemists, veterinarians, pressmen, and other farmers his method. He has also supplied, at a nominal price,

FIG. 1. SIX-YEAR-OLD HEDGE AT TURIWIRI, NORTHERN WAIROA.
[*Photo, Geo. Short.*

roots to those desiring to make experiments. Success has not come to Mr. McClean without perseverence in the face of many obstacles. Without knowing any of the previous opinions or work of others with pampas, and without any official guidance and advice, and, as he puts it, in the face of all sorts of discouragement and carping criticism which required quite a lot of determination to disregard, he has demonstrated beyond doubt that a new fodder plant is available which is destined, it is thought, to have very far-reaching effects in cheapening production in every branch of cattle-farming.

Being a grass, this new fodder is particularly suitable for balancing the diet of cattle when the tendency is for the protein of the natural diet, pasture, to rise to excess of requirements as exhibited by many high fertility pastures in late summer and autumn when clovers often predominate to such an extent that the pasture presents the appearance of a clover ley. Green maize is often used as a summer supplementary soiling crop for dairy cattle, but the production of green maize is expensive, considering that the plants only last one season and require preparation

of the soil, manuring, and finally carting of the crop, all involving labour and expense, whereas pampas is a perennial crop which can be grazed *in situ*, and will smother all competing weeds. The charge made for the roots is £1 10s. per 100 f.o.r., so that the cost for an acre is £15, and two years from the date of planting, as well as in subsequent years, it will support with suitable run-off over fifty head of mature stock for ten weeks, so that, viewed as an investment, the plantation of 1 acre of pampas is an eminently payable proposition.

The writer does not advise farmers to go to the expense of buying enough plants for an acre until they have tested the matter on a small scale. In gardens this plant is apt to outgrow its welcome and when once a clump has established itself in a garden it requires considerable effort to eradicate or even reduce it. Hence any farmer desiring plants

FIG. 2. ALL THAT REMAINS OF 2 ACRES OF PAMPAS GRASS AFTER 130 HEAD OF GROWN STOCK HAVE WINTERED THEREON FOR TEN WEEKS.

Burning the rubbish is all that needs to be done before closing up for next winter's feed. [*Photo, C. R. Taylor.*

has only to ask his friends who will probably be glad to give him permission to take as much as he wants, but this will be a strong man's job.

Pampas does not appear to spread from seeds in the southern portions of the North Island, but in the Auckland and North Auckland districts it is regenerating rapidly by this method, especially on railway enclosures and waste lands. It is readily distinguished from toetoe by the stouter, taller habit and denser plumes.

The result of pampas feeding on Mr. McClean's own cattle has been the subject of investigation by competent visitors who have expressed their appreciation of the condition of the stock on the farm. Although milking what is called "a very ordinary herd," mostly Jerseys, he is topping his district against all suppliers for amount of butterfat per cow per month, which is shown by the factory returns, although many

of his neighbours have well-bred stock with high butterfat records. Mr. McClean's results are all the more remarkable as no top-dressing is done on his farm. The soil is not excessively moist in Ngatea and in summer months it becomes decidedly dry. The soil is peaty, the subsoil being a rich clay. For further information of the Hauraki Plains soils see this *Journal*, June, 1914.

Mr. C. R. Taylor (country assistant to the Chemistry Section at Rotorua), with a view to determine the value of pampas in the pumice lands, met Mr. McClean at Rotorua and at his request afterwards visited his farm at a time when the pampas feeding was in full swing—August,

FIG. 3. A NEW STAND OF PAMPAS GRASS JUST PLANTED: PLANTS ARE 6 FT. APART, TWENTY ROWS WIDE.

[*Photo, A. McClean.*

1933—a previous visit having been made in midsummer. His photos show that the stock are in wonderful condition and attack the giant tussocks with evident relish, which is not the result of undue starvation, but the palatableness of the pampas. Nothing appears to be wasted, as the stock eat the tufts almost to the ground including some of the dried-up material—even the plumes.

Mr. McClean's method of laying out his plantations is simple and efficient. An area 1 to 2 chains wide and several chains in length is planted in the spring with pampas roots 6 ft. apart which provides approximately one thousand plants to the acre. These are not fed off until the second year, by which time the estimated yield of green

material per plant is, roughly, 1 cwt., or 50 tons to the acre. This figure, so far as weight is concerned, compares more than favourably with the yield of the average swede crop as grown in New Zealand. In dry matter the pampas is much richer than swede or mangel. During the winter ending September, 1932, Mr. McClean wintered 106 head of grown stock on 2 acres of pampas with only a 40-acre run-off paddock. This gives some idea of the great ultimate winter carrying-capacity of his 200-acre farm when the whole 10 acres of pampas now being grown is ready to feed off. It is considered that it will not be necessary to grow more than 10 acres for winter feed when the farm is fully developed and stocked to capacity.

During the past winter Mr. McClean has fed 130 head of grown stock and 70 head of young stock on 2 acres of pampas with a run-off of 48 acres. Feeding-off was commenced on the 14th June, 1933,

FIG. 4. CATTLE ON LAST "BREAK" OF ORIGINAL 2 ACRES.

Note condition of stock and the manner in which pampas tussocks in foreground have been eaten down.

[Photo, C. R. Taylor.

and finished on the 20th August, a period, approximately, of ten weeks. Reckoning two thousand plants to the 2 acres, this provides two hundred plants per week for 130 head, or, roughly, one and two-fifths tussocks per beast per week. Allowing 1 cwt. of green material per plant, each animal will consume 160 lb. of green material per week in addition to that obtained from the pasture run-off. Under the conditions obtaining at Waitakaruru (latitude 37° south), this amount of supplementary fooder appears sufficient to maintain stock in good healthy condition. In more rigorous climates one would expect a greater consumption to be required to produce the same results. The method by which the cow with its soft mouth is able to demolish and graze these tall sedge-like growths varies with the individual. Some animals favour pulling the canes from the base while others take hold of the leaves almost at the tips. Either method

appears to be equally easy to stock and causes them no inconvenience whatever. Next year there will be available on this farm from 8 to 10 acres of pampas, some of which will be reserved for an experiment in summer feeding.

The proper time to plant pampas is at the beginning of spring or after the worst of the frosts are over (see Fig. 3). Frost undoubtedly cuts back an inch or two of the tender young growth, but not sufficient to do material harm to the plant. New plants are obtained by subdivision of old matured clumps into single shoots with just a little of the root attached. A sharp-edged spade makes a useful instrument for cutting out new plants from old tufts. No particular care or skill appears necessary in planting new areas so long as the right season is chosen. New plantations should be allowed to grow and develop until their second year from planting, after which they may be grazed regularly either in winter or summer as may be most expedient. Following the feeding-off in breaks the whole of the residue left by the stock, consisting of dry mounds of dead leaves is fired, which clears up all the wasted material tramped under foot and neglected by the stock and reduces the tufts to a reasonable size (see Fig. 2). Firing appears to favour the subsequent development of a more luxuriant growth which may be partly explained by the fertilizing effect of the ash. Mr. McClean's methods and stock were carefully examined by Mr. C. R. Taylor, from whom and from the owner himself the writer derives his information, and could find nothing to which he could take exception. Mr. McClean's revolutionary practice is certainly giving excellent results at present, and there is not the slightest evidence that might indicate any ill effects to the cattle from grazing as a supplementary fodder such an apparently rank material as pampas grass. The fibre is very short in the grain and the leaves readily break up into the smallest pieces.

Perhaps the feeding of pampas may be extended to cover supplementary requirements of early spring when stock tend to scour, for which it is an antidote if similar in action to toetoe (Goldie), and late summer when the pasture tends to be overloaded with clovers and therefore requires balancing with a diet less rich in protein and still palatable, which pampas certainly is. The feeding of excess of protein is wasteful and, some authorities hold, injurious (see this *Journal*, February, 1929, p. 97).

Droughty summers are not unknown in the North Island dairying districts, when the pastures dry up and the cattle suffer. It is easy to see that such a drought-resistant grass as pampas is likely to be a good insurance against the ill effects of food-shortage on a valuable herd at a time when other supplementary fodder is not available.

Conclusions.

Pampas grass grows at the rate of a foot or more a month from the divided root-stocks when planted out in the paddocks, and one thousand plants may be set in an acre of ground. In from eighteen months to two years these plants may be fed off in breaks which yield 50 tons of green matter to the acre. Cattle are very fond of the plants in their second year, and even ordinary grade cows improve in condition and give an increased butterfat test immediately they commence grazing this new fodder, the rise in the test being as much as 0·3 per cent., which

is lost if the cows are taken off the pampas. Cows remaining on pasture as a control show no increase. This is the result of two years' experience. Pampas tussock, if to be used for grazing, should not be fed off later than the second year; if left until the third year, although better for shelter, they are more difficult to graze. After the first year's grazing the tussocks may be grazed regularly every year. After the plantation is eaten down it is cleaned up by fire to destroy the dead rubbish. In a few days may be seen emerging from the charred remains of the pampas tussock many green shoots which grow so rapidly that in six months they may reach 7 ft. in height.

Compared with ordinary pasture grass, which has 75 per cent., pampas only contains 70 per cent. of water, while turnips contain 90 per cent. Hence pampas is rich in dry matter compared with other green fodders.

Mr. C. R. Taylor in going through the pumice country has taken the opportunity of inspecting shelter-belts of pampas, and finds them regularly grazed every winter by stock leaving good pasture to do so. He concludes that pampas has an economic value hitherto undreamed of and a definite place in every farm in the future.

The difficulty of providing winter feed on a bush section where there is no ploughable land may possibly be overcome by the use of pampas.

MANAGEMENT AND FEEDING OF THE DAIRY HERD DURING THE WINTER MONTHS.*

J. E. McIlwaine, Acting District Superintendent, Live-stock Division, Department of Agriculture, Wellington.

The customary autumn decrease in the milk-yield is due to several factors. In the first place, as the growth decreases in the paddocks so does the food-supply which acts as the stimulant to milk-production. During the late autumn, and more especially during the winter months, grass-production is at its lowest. The growth that has been left over from the previous spring and summer tends to become dry and fibrous and loses its high feeding-properties. The young leafy pasture, which is so nutritious for the production of milk, has to a great extent been eaten down and is not replaced during these months. This fact, together with the natural tendency to the cessation of milk-production as the dairy cow becomes advanced in pregnancy, accounts for the gradual drying-off of the herd. This period of rest for the dairy cow is very beneficial for the animal, provided reasonable care and attendance is bestowed. The rest period allows the animal time to build up her system which has been subject to a strain of heavy depletion. In young animals the rest period also allows a space for growth and further development of all parts of the body. In all animals a rest period of at least two months should be allowed if the constitution of the animal is to be maintained.

* Substance of an address broadcast from Radio Station 2YA, Wellington, April, 1934.

As the season comes to a close, those animals which are not considered a profitable proposition are culled and removed from the herd, being disposed of to the best advantage. Culling may be necessary for many reasons. It may be necessary to reduce on account of a shortage of winter feed the number of stock carried during the winter months. At this stage, from the point of view of good animal husbandry, it is better to reduce the numbers in the herd during the winter and feed the remaining stock in a reasonable manner than overstock and partly starve all members of the herd. Such alternatives as the removal of dry stock and young stock to other grazing to conserve the feed remaining is often considered by the dairy-farmer. Young stock and dry stock as a rule do fairly well on a good paddock of roughage, provided there is plenty of roughage and reasonable shelter. In the provision of this roughage it is advisable to see that the paddock does not contain tall fescue or other ergotized pasture. A few seasons ago visits to farms where cows were affected with ergot poisoning illustrated the need for care in this matter. One farm was in the Wairarapa district and the other farm was in Marlborough. On both farms the supply of winter feed was used up, and in each case the cattle were moved to pasture in a paddock where the tall fescue had been allowed to get away and where it was very badly affected with ergot. As a result, several cows on each farm were severely affected with ergot poisoning, with the characteristic lesions of this complaint. It was found necessary to destroy several animals as recovery was out of the question.

Culling generally takes place at the end of the milking season. If herd-testing has been carried out, the natural thing to do is to remove the cows which are unprofitable. The good cows are kept even though they have lost a quarter, as their value from a breeding point of view must be taken into consideration. It is necessary to cull animals on account of disease. Cows that have been affected with mammitis in one or more quarters of the udder are not good animals to retain, as the tendency is for this trouble to recur in the following season. An animal affected with tuberculosis must be removed from the herd. Shy-breeding stock and stock affected with other defects should be removed. Probably the main cause of culling on many farms is the prevalence of udder trouble in some form or other. With culling and the removal of undesirable animals, accompanied by careful attention in drying-off cows, a reasonably healthy herd should remain.

It should not be necessary to state that the drying-off of dairy cows is very important so far as the preservation of the udder in a healthy condition is concerned. The usual practice adopted is to milk cows once daily when the cows go down in their yield. This procedure is carried on for a week and following this the intervals between milking lengthened. When milking has been finally stopped it is advisable to inspect the herd carefully a few days later to see that no udder is filling up again and requiring further attention. The leaving of milk in the udder of a dry cow is a frequent cause of mammitis the following season, and too much care cannot be taken in regard to this matter.

Occasionally an animal will be found which is very difficult to dry off. This may be due to the inherent milking-qualities of the animal or may be due to a liberal food-supply. In such a case the food-supply should be cut down, a laxative dose of medicine should be given, the intervals between milking should be gradually increased, and an astringent lotion such as alum may be applied to the udder.

At this season of the year farmers will be encountering cases of abortion in their herds. Young heifers with their first calves are liable to this disease on infected farms. When cases of abortion occur it is advisable to isolate the animals, to bury or burn all discharges, and to take measures to prevent the spread of the infection on the farm. Whether an affected heifer will be worth milking will depend on the date at which abortion takes place. A heifer or cow affected with this trouble should be attended to by the provision of shelter, a rug, by medicine, or by douching in order to prevent complications and to ensure the animal remaining in good health.

Cases of abortion at times are caused by rough handling. Hence heifers should not be hunted by dogs, be bustled into and out of yards and gateways, and the same remarks apply to the dairy herd in general at this season. Careful handling of dairy stock is at all times advisable, special care being necessary from autumn onwards.

The food-supply of the herd during the winter months is an important factor in the maintenance of health and good condition. Dairy cows require to be well provided for even during the dry months. Cows should not be allowed to fall away in condition as, if they do, good results cannot be expected next season. A cow should be in good condition at calving-time, not necessarily fat, but with something to spare, as the drain is heavy until the spring feed comes away. With a herd in good condition at calving-time the peak of production is reached a few weeks after calving, whereas with a herd in poor condition the peak is not reached until the spring is well advanced. Moreover, the amount of trouble experienced at calving-time will be considerably reduced in those herds which have been well fed and well cared for. The shepherd finds it necessary to go round his flock last thing at night and first thing in the morning during the lambing season. The dairy-farmer must do likewise to ensure that everything is satisfactory.

The food-supply for the winter may consist of some roughage, which may be hay and roots and it may be silage or a combination of these staple foodstuffs. Whatever it is, it is advisable to see that the stock get an adequate daily allowance of a wholesome nutritious supply. When hay is being fed in fairly large quantities daily it is necessary to see that the water-supply is plentiful. Hay should be fed out in racks in preference to being spread out in the paddocks. The rack method is more economical and the hay is not trampled down and soiled. Hay of good quality is highly digestible and nutritious ; poorly saved hay, on the other hand, has a low food-value and is liable to cause indigestion and impaction. It is therefore advisable when feeding poor-quality hay to combine some roots in the daily ration, to see that a plentiful supply of water is available, and to provide a lick of agricultural salt. When hay of

low quality is being stacked or baled it is a sound practice to sprinkle the layers with agricultural salt. It improves the keeping-qualities of the hay and renders it more digestible.

Where roots, hay, and ensilage are available the common practice is to feed off the soft turnips with hay in the early part of the season, leaving the silage and the swedes and mangels till later in the season. The soft turnips will not keep, whereas the silage will keep almost indefinitely. It is always advisable to feed some hay with the roots. Large quantities of roots by themselves are liable to cause indigestion and scours and may lead to dysentery and "red-water." A better balanced ration is obtained when hay and roots are combined.

Mangels, unless fully mature, require to be pulled, stacked, or pitted some weeks before being fed out to stock. This procedure increases the sugar content of this crop and prevents the possibility of scours, which are frequently seen when the crop is fed immediately after being pulled. Although all roots contain a very high percentage of water they are much valued by stock-owners who prepare animals for show and sale. Roots contain a small percentage of dry matter which is highly digestible, the percentage of fibre being low. They have been described as watery concentrates.

Silage is being used more and more throughout the dairying districts as the mainstay of the herd during the winter months and during other periods of scarcity. Grass silage is the crop most favoured in New Zealand, and is as popular in this country as corn silage is in the United States of America. Silage has many advantages over hay and roots as a winter food-supply for the herd. Surplus spring growth can be converted into silage much more satisfactorily than into hay in a rainy season. There is not the same risk of deterioration and wastage when making silage. In regard to roots, the chance of a good crop in this respect depends upon several factors; in fact, in some districts it is a relatively difficult matter to grow a good crop of roots. Silage can be prepared in any district with reasonable conditions for the growth of pasture.

As a foodstuff for the dairy herd during the winter months silage is extensively used. It is succulent and nutritious and a very useful ration for dry cows or cows in milk. Properly conserved, it is rich in minerals, a necessary food constituent for a pregnant animal or a producing animal. The feeding-value of silage for milk-production is high: $2\frac{1}{2}$ lb. of silage are superior to 1 lb. of meadow hay. In a trial in a dairy herd where silage was used to replace both hay and roots it was found that $8\frac{1}{2}$ lb. of silage had a higher feeding-value than 10 lb. of mangels and 1 lb. of hay. Some of the protein in silage is in the partly digested amino-acid stage. Stock do very well on silage, give a good return, and retain their bloom.

The question of the mineral content of stock-foods has been receiving more and more attention of late years. It is opportune here to say a few words about the mineral content of the winter foods discussed above. In regard to the mineral content of silage, the mineral content of the grass crop can be conserved in the silage when the silage is made in dry weather. Some drainage may take place under other circumstances, but, generally speaking, silage is rich in its mineral content. Its mineral content can be increased by the inclusion of high-class plants such as the clovers and lucerne. Likewise, the mineral content of good quality

clover or lucerne hay is high. Hay which has been cut too late in the season, or hay which has been leached or subjected to rain is low in mineral content. Roots are low in their mineral content. Where low-quality fodders are being fed, both the protein and mineral content of such fodders are low. It may therefore be advisable to supplement the winter foods in use on many farms by the addition of a mineral lick. Agricultural salt should be provided for all dairy stock on all farms during the winter months. This can be added to by the addition of 25 to 50 per cent. of bone-meal or bone-flour. The addition will provide calcium and phosphorus, two minerals specially required by dairy cows even when dry, and more particularly required by dairy cows which are being milked through the winter months.

It has been shown that the dairy cow depletes her mineral reserves throughout the milking-season. The dry period is then a suitable time to build up again. There is some evidence to show that such diseases as tuberculosis, contagious abortion, and sterility are in some cases more apt to occur in herds where the mineral-supply is low.

NOTES ON RECENTLY OBSERVED EXOTIC WEEDS.

H. H. ALLAN, Plant Research Station, Palmerston North.

(8) Horse Nettle and Buffalo Bur.

THESE objectionable relatives of the potato belong to the same genus (*Solanum*) and have similar flower and fruit structure, but belong to the section bearing stout prickles on the stems and leaves. Another distinguishing feature is the presence of branched hairs, the branches arranged in a rayed fashion (stellate). Both are considered to be poisonous, but it is very rare for stock of any kind to touch them, though sheep have been known to nibble at the fruits of the horse nettle. The solanums are readily recognized in flower by the five long anthers, which are usually closely placed round the style, and which open by pores at the tips to release the pollen. The berry or "apple" is two-celled with numerous seeds. Another member of this prickly section of the genus is the apple of Sodom (*S. sodomaeum*). This was first noted in New Zealand about 1882, and is now found throughout the Auckland Province, favouring light dry soils and waste places. It is briefly described here for comparison.

The following key may assist in identification :—

1.	Flower yellow, fruit covered by the prickly calyx	*S. rostratum.*
	Flower purplish or violet, fruit extending beyond the calyx as an "apple"	2.
2.	Plant shrubby, fruit about 1¼ in. across ..	*S. sodomaeum.*
	Plant with far-creeping roots, herbaceous, fruits about ½ in. to ¾ in. across	*S. carolinense.*

HORSE NETTLE—*Solanum carolinense* (FIG. 1).

An herbaceous plant, becoming more or less woody at the base of the stems, with a deep root-system. Spreads by means of horizontal

roots, which may extend to 3 ft. through the soil and send up shoots at intervals. Stems 1 ft. to 2 ft. tall, more or less straggling, and bearing, as do the leaves, numerous stellate hairs, with four to eight

FIG. 1. HORSE NETTLE, SPECIMEN FROM TE PUKE.

rays. The stems, mid-ribs, and sometimes other veins of the leaves are armed with stoutish yellow prickles. The leaves are from 2 in. to 4 in. long, more shallowly lobed than in the other two species, and rather greener in colour, with usually a more pointed tip. The calyx

has slender teeth, and bears few or no prickles. The corolla varies from violet to light blue or white and resembles that of the potato. The berries are from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. across, orange-yellow when ripe, with a disagreeable odour.

FIG. 2. BUFFALO BUR, SPECIMEN FROM WHANGAMOMONA.

This species is a native of the Southern States of North America, but has extended its range, and in Iowa especially has become a bad pest. It is a perennial, and its root-system makes it difficult to cope

with once it has become established. American authorities recommend frequent cultivation of infested areas to weaken the plant, followed by a smother crop. Sudan grass, sorghum, vetches, rye, and other quick-growing crops capable of providing a dense cover are used. In bad cases this treatment has to be applied for two or three seasons. Small patches may be killed outright by the use of hot brine, caustic soda, or kerosene. Sodium chlorate in the ordinary strengths has not proved successful, apparently not checking the root-growth sufficiently.

Horse nettle has recently been sent in by Mr. C. Walker from Te Puke, where it has become aggressive in one paddock. Prompt action may prevent its spreading further.

FIG. 3. APPLE OF SODOM, SPECIMEN FROM AUCKLAND.

BUFFALO BUR—*S. rostratum* (FIG. 2).

This is more erect than horse nettle, and lacks the extensive root-system. It is usually more yellowish in appearance, owing to the greater development of stellar hairs. The prickles also are more numerous and rather stouter. The leaves are rather melon-like in shape, much more deeply lobed than in horse nettle, and with narrower segments. The tip is more rounded. The calyx teeth are sharply pointed and the corolla is yellow. One anther is much larger than the other four, with an incurved beak (hence the name *rostratum*). The berry remains enclosed when ripe in the very prickly calyx.

This is a native of the plains region between the Missouri River and the Rocky Mountains, but has also greatly extended its range. It is the original host of the potato-beetle. As it is an annual, remedial

treatment is simpler if taken in hand in time. The aim should be to prevent seeding by frequent cutting of the plants. If fruits have already formed the cut plants should be burnt.

FIG. 4. APPLE OF SODOM.

Illustration from "The Weeds, Poison Plants, and Naturalized Aliens of Victoria," by A. J. Ewart and J. R. Tovey (Melbourne, Government Printer).

This weed was observed by Mr. E. A. Madden at Whangamomona, but in very small quantity. A lookout should be kept for stray plants, as a few neglected plants would soon provide a rich harvest of seed.

APPLE OF SODOM—*S. sodomaeum* (FIG. 3).

This is a spreading shrub up to 3 ft. tall. The leaves (Fig. 4) are deeply lobed, the lobes broader and more rounded than in buffalo bur. They are from 3 in. to 6 in. long. The calyx teeth are blunt, and the corolla purplish to violet. The berries are variegated green and white, becoming yellow when ripe, and reaching an inch or more across.

It is a native of the Mediterranean, and has been naturalized in Australia for many years, where it has given much trouble. It is a perennial, but succumbs to repeated cutting. Australian experience is that two or three cuttings a year soon exhaust it.

CONTROL OF CELERY-SPOT DISEASE.

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CELERY-SPOT disease, commonly called "rust," is the greatest enemy to successful production of celery. An account of the disease and its control appeared in this *Journal*, Vol. 26, p. 289, May, 1933. In this article successful control of the disease was claimed, "subject to confirmation by further experiments next season," by a seed-treatment combined with certain sanitary precautions. The treatment consisted in dipping the seed for ten minutes in water held at 136° F. During the past season a line of heavily infected celery-seed of the "White Plume" variety was treated by this method, grown under glass at the Plant Research Station, and the resultant plants distributed to eleven gardeners at widely separated parts of the district. Of these plantings only one developed celery-spot, this being in a town garden in which severely infected plants had been present during the preceding season. A control sowing of the same seed untreated developed early and severe infection.

It appears, then, that the method can be relied on to produce plants which are free from the disease, and which will remain free if reasonable precautions are taken to avoid infection from previous or contemporary infected celery-plants.

RUSSET ON APPLES.

N. J. ADAMSON, Orchard Instructor, Hastings.

ONE class of russeting commonly produced on apples and considered to be due to many causes has its origin in frost injury. Apples which have been damaged by frost in the early stages of development are readily recognized by a flattening of the calyx end. It has been observed that in frost-affected areas many injured fruits which have continued to grow, carry a heavy russet around the calyx.

Although in many instances there may be a degree of russeting, with no apparent frost injury, as indicated by a flattening of the

fruit, the heavy type of russet damage around the calyx is confined to fruits which have been more severely frost-injured and which show damage in the flesh.

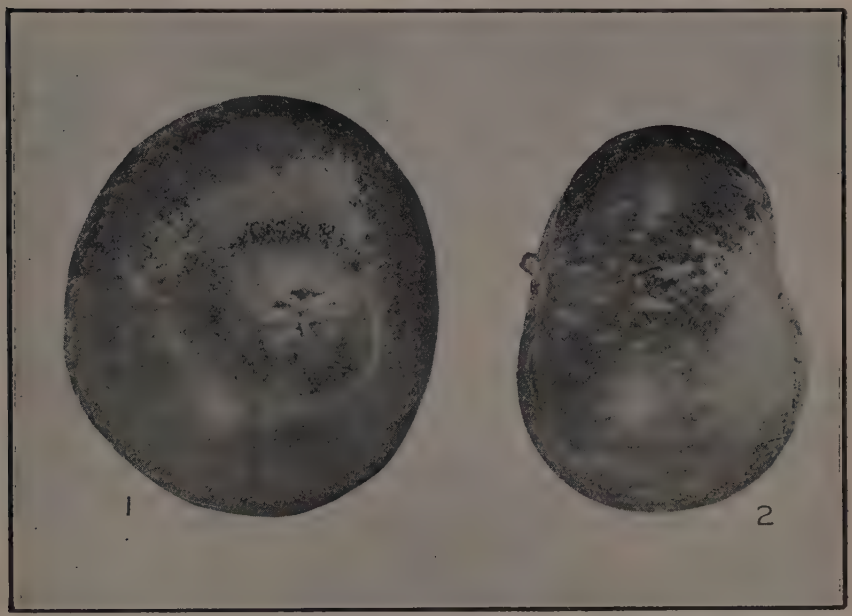

FIG 1. RUSSETING OF THE FRUIT DUE TO FROST.

FIG. 2. FLATTENING OF THE CALYX END CAUSED BY FROST.

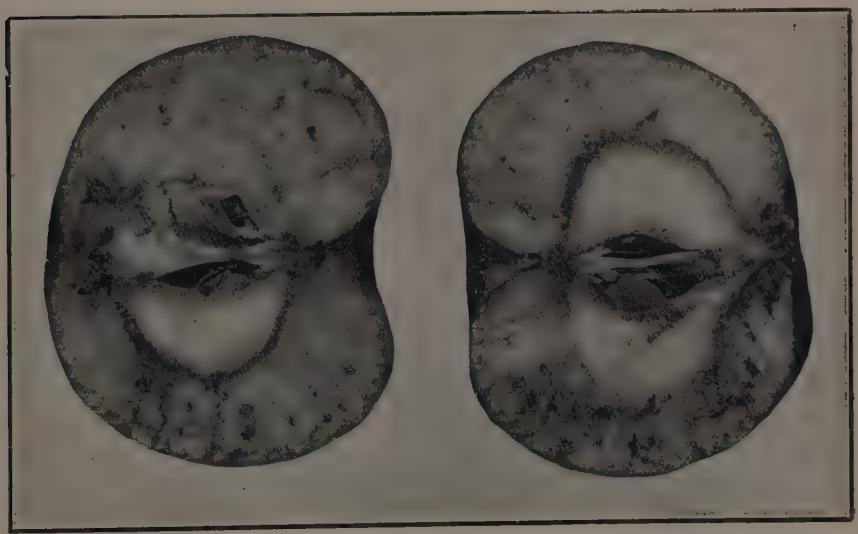

FIG 3. INJURY TO THE FLESH WHICH HAS FOLLOWED.

[*Photos by H. Drake.*

The illustrations show the characteristic russeting on frost-injured fruit, the flattening of the calyx end of the apple, and the injury to the flesh which has followed.

PASTURE MANAGEMENT: GOOD "CONTROL" OF PASTURES IS NOT NECESSARILY GOOD "MANAGEMENT."

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THE object of this article is to marshal and present a few facts regarding the utilization of pasture herbage and their bearing on production, more particularly on sheep-farms on our medium- to better-class lowland sheep-country.

It has been amply demonstrated that under similar conditions of closeness of grazing the more frequently a pasture is grazed or cut the lower will be its production, or, conversely, the longer the spelling periods between grazings the greater will be the production.

The mention of spelling periods implies intermittent grazing and spelling or what is commonly called "rotational grazing." It is a comparison of this system with that of a "set rate of stocking," which is the more commonly practised one on sheep-farms, having for their object the production of fat lambs, that the writer desires to focus attention on.

Evidence in support of the statement regarding frequency of grazing is abundant, and a few examples provided by research work in Britain, Australia, and New Zealand will be drawn on for its substantiation.

As a result of cutting pastures at varying intervals Woodman and co-workers (1, 2, and 3) at Cambridge, England, obtained the following results. In 1927 pasture cut at fortnightly intervals yielded 10 per cent. more dry matter than when cut at weekly intervals. In 1928 fortnightly cutting resulted in an increased production of dry matter of 29 per cent. over weekly cutting, and three-weekly cutting in 62-per-cent. increase over weekly. In 1929 and 1930 the comparison was extended to one of monthly versus weekly cuttings. In each of these seasons monthly cuts yielded 45 per cent. more dry matter than weekly cuts.

The above does not mean that three-weekly cutting caused a greater increase over weekly cutting than monthly cutting did. The monthly cutting, although carried on on the same pasture as the three-weekly, was done in different seasons. The vagaries of climate, no doubt, influenced the magnitudes of the superiority of three-weekly and monthly respectively over weekly cutting.

That the influence of severity of cutting or grazing in one year may be reflected on production in the following year has been demonstrated by Stapledon(4) on, amongst others, a dense pasture of cocksfoot.

Treatment in 1922.	Relative Yields from Eight Cuts in 1933.
(1) One hay crop and two aftermath cuts	100
(2) Cut monthly (ten cuts)	94
(3) Cut fortnightly (twenty cuts)	61

Again, at Aberystwyth, Jones and Jones(5) found that a pasture subjected to different periods of spelling between grazings gave appreciably different amounts of live-weight increase per acre from lambs grazed thereon.

With monthly resting periods 175 lb. live-weight increases per acre were obtained against 167 lb. and 132 lb. for fortnightly and four-days resting period respectively. In other words, the live-weight increases were 26 per cent. and 32 per cent. greater with fortnightly and monthly spells between grazings respectively than with four-day spelling periods.

At the Imperial Chemical Industries' Agricultural Experiment Station, Jealott's Hill, M. G. Jones(6) compared the effect of close and frequent cutting or heavy grazing on the one hand with cutting less frequently and severely or grazing lightly on the other hand, on root development. The comparison was made on five different types of swards, with the result that on the average there was a 63 per cent. greater weight of roots to a depth of 6 in. on the less frequently cut or less severely grazed portions than on the more severely treated ones.

In South Australia Richardson(7) compared monthly cutting with cutting at two-monthly intervals on an irrigated pasture, with the result that over a period of one year the two-monthly cutting gave a yield 28 per cent. greater than monthly cutting did.

At Lincoln College in Canterbury(8) the carrying-capacity under a system of "intensive" (rotational) grazing was compared with the carrying under "extensive" (set rate of stocking) grazing. Over a period of two seasons 6·8 sheep per acre were carried on the intensively grazed area against 3·8 sheep per acre under extensive grazing.

In an investigation carried out at the Marton Experimental Farm(9), 1929 to 1932, cutting pasture at a "sheep-grazing" stage was compared with cutting at a "cattle-grazing" stage. Intervals between cuts ranged from five to seventy-four days when cut at sheep-grazing stage and from twelve to ninety-nine days at the cattle stage, depending on the time of the year. The less frequent cutting resulted in 10 per cent. greater production of the green herbage than the more frequent cutting.

Other examples of the effect of frequency or severity of defoliation on production could be quoted, but those given should be sufficiently convincing.

In every case, and the writer has seen no exceptions recorded, the less frequent cutting or grazing has resulted in greater production of herbage, greater carrying of stock, or greater root-development, as the case may be, than more frequent cutting or grazing.

It should be noted that in the cases quoted where cutting has been carried out the most frequent defoliation occurred at weekly intervals. I would regard this relatively severe defoliation as very lenient, compared with that taking place on our sheep-farms, especially in the early spring months. Where the stock are spread over practically the whole of the available grassland they are consuming the herbage as fast as it grows. Virtually, during the early spring months of August and September and at times when growth is even slower than in these months they are doing what Mr. Cockayne has aptly described as "eating day-old grass." It is obvious from the results quoted that the mere fact of keeping the pastures continuously short is in itself limiting their capacity to produce: hence the title of this article "Good 'Control' of Pastures is not necessarily Good 'Management'." The leaf is as essential to the well-being of a plant as the root, and the

capacity to produce is governed to a considerable extent by the amount of leaf which a pasture plant is permitted to produce before it is consumed by stock.

If, instead of continuous defoliation at times when rate of production is below the consumption-capacity of stock, a system of intermittent grazing and spelling is adopted an appreciable increase in production of herbage must result. This can be achieved by rotational grazing. That such a system is practicable and productive of outstanding results is borne out by the evidence presented in an article by McCulloch and Connell in the current issue of the *Journal*.

Just what lengths the resting periods between grazings and the ntensity of stocking should be must be governed by circumstances. Although long spells of three or four weeks will result in greater production than if one-week resting-periods are adopted, it is obvious to any one who has attempted intensive grazing with sheep that such lengthy periods would, under some circumstances, be productive of disastrous results.

When grass growth is prolific on good land and the climate wet, a resting-period of more than one week may mean a growth such that when the pasture is heavily stocked a large amount of soiling with consequent waste of herbage will result, to the detriment of stock. Under dry soil and climatic conditions or when growth is less rapid fortnightly or longer resting-periods may not be too long.

One must generalize, and say that, *under a system of rotational grazing, pastures should be spelled for as long a period as possible between grazings commensurate with good utilization by the stock employed.* Good utilization will almost certainly mean good thrift in stock, but good utilization does not mean severe and extremely close grazing which may offset the advantages of spelling. Sound common-sense and a knowledge of local conditions are necessary for the most effective application of the principles embodied in good pasture management.

If the evidence presented which serves to indicate in some measure at least one of the reasons for high carrying-capacity on the farm described by McCulloch and Connell only gives the "set rate of stocking" advocates food for thought, the writer feels that some good at least must eventuate.

To those who say that lambs will be mismothered and cannot be fattened under rotational grazing, that intensive stocking with sheep will result in an undue amount of disease, or have any other real or imaginary objections, it is suggested that they read the article by McCulloch and Connell on what has been achieved by a Marton farmer.

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SEASONAL NOTES.

THE FARM.

Planning of Field Work desirable.

At this time of the year the planning of future farm operations may very fittingly be carried out. That it is a task of major importance seems often to be disregarded, yet it has been well established by experience that in farming the greatest reward has gone to those whose operations are best planned, who plan their operations well in advance, and adjust their farming to suit the needs of the times. Never was there greater need for efficiency of farm production. The wide differences in the general efficiency of farmers arise largely from differences in the efficiency of their planning. There is every reason to expect that rewards in farming will continue to correspond with efficiency.

One matter worthy of consideration in planning is that sound farm management involves the distribution of labour requirements in such a way that the idle days at one period and the overcrowded days at other periods are both avoided as far as possible. The approach of the relatively slack period in the year of many farmers makes it seasonable to consider how any rush and bustle in spring and summer may be reduced by attending in the slack period to such jobs as fencing, the construction of ensilage pits and trenches, the repair or adjustment of equipment, including farm machinery, and the preparatory work in the production of special crops for use in periods of scant growth of pastures.

One of the strong reasons for the prolonged adherence to traditional systems of rotational cropping was that they provided for full and economical use of all farm labour throughout the year and obviated either a rush of work or a slack period. New Zealand farmers commonly have adopted the economically sound course of cropping on the basis of market prospects instead of conforming strictly to any specific systems of rotational cropping. Although it has at times been advisable to forgo some of the advantages of rotational cropping, it is well to bear in mind that rotational cropping has considerable academic merit which should be exploited if at all practicable.

Planning according to Needs of all Stock.

A matter of primary importance in the planning of cropping is the needs of all the stock at different periods throughout the year. Judging by results, it would seem that often the provision of feed is based on the requirements of the class of stock of major importance, while those of stock of less but of considerable potential importance are ignored. For instance, on North Island dairy-farms the cropping often seems to make little or no provision for pigs and poultry, and similarly on South Island mixed farms on which grain and sheep are dominant the needs of small dairy herds and of pigs are ignored: this, in both Islands, with consequent substantial detriment to the total returns.

Bearing of "Twitchy" Weeds on Planning.

Another matter which requires to be taken into consideration in planning cropping is the suitability of the soil and climate for particular crops. In this the weed population of the ground is of moment. For instance, an old pasture which is to be broken up this season should, if "twitchy," be utilized in a different manner from an old pasture which is not "twitchy." The latter, with success, may be skim-ploughed in the winter,

worked, and then deep-ploughed in the spring, and sown in a spring or summer crop such as lucerne, mangels, potatoes, peas, rape, turnips, or barley. But if the old pasture is twitchy, if possible it should not be broken up in the winter or spring, but left till mid-summer. Then, in December or January, it may be broken to a depth of 2 in. or 3 in., cultivated till February or early March, and then ploughed deeply—to a depth of 7 in. or 8 in. if possible. In this ploughing it is well to employ a skim-coulter to assist in burying as completely and deeply as possible all portions of the twitch. Alternatively, one deep ploughing in summer, also with a skim-coulter utilized, may be employed. In either case subsequent cultivation should be of such a nature that it will not bring portions of the twitch to the surface again. Further, the cropping should be planned so that the weakening of the twitch which was started by the summer tillage will be continued by the "smothering" effect of dense, vigorous crops, the first of which should be sown in the autumn. For this purpose oats and tares are practically ideal, provided good cultivation is associated with liberal manuring so as to result in a heavy crop which will "smother" effectively the twitch in the spring. An autumn-sown temporary pasture of Italian rye-grass and red clover or an autumn-sown crop of Algerian oats is also serviceable. As far as possible, such crops usually should be followed by another leafy shading crop to complete the suppression of any twitch that remains. Other fairly satisfactory shading crops are peas and rape. The essential features of twitch control are—(1) preliminary surface summer cultivation to weaken the twitch, especially if the climate is dry enough to facilitate the weakening process; (2) deep and thorough burial of the remnants of the twitch; and (3) smothering by dense cropping.

The method of twitch-control is of importance apart from the treatment of land infested with twitchy grasses, for it embodies a general principle which should come into operation, in methods suitably modified, for dealing with such weeds as sorrel, blackberry, yarrow, tall fescue, and Californian thistle. The economic control of such weeds should be based not on direct attack through cultivation, such as is given by relatively extensive summer fallowing, but on a system of cropping which will pay for itself and which often may well contain as a valuable initial step suitable summer cultivation.

Annual Weeds call for Consideration.

Another aspect of weed infestation should be considered when future cropping is being planned. It is concerned with annual weeds such as fathen, spurrey (yarr), nightshade, and willow-weed, which often germinate in the spring instead of at other times. Crops to occupy land known to be infested with such weeds should be sown in the autumn rather than in the spring. The influence on weed-control of the date of sowing is often well illustrated when wheat is sown on land infested with fat-hen seeds. While the fat-hen is likely to compete strongly with the spring-sown wheat and thereby lessen the returns, it is unlikely to be much in evidence in the autumn-sown wheat. There is likely to be similar differences in the intensity of spurrey invasion of spring-sown and of autumn-sown crops. It should be borne in mind that the avoidance of trouble from annual weeds for one season in the manner just described by no means frees the land from weed-seeds: the seeds of many weeds, including fat-hen and spurrey, are capable of remaining in the ground alive and vigorous for many years. Because of this, land heavily infested with such weeds should, when possible, be sown in pasture which—provided the pasture continues satisfactory—should not be ploughed under until this is necessitated by circumstances.

In planning the cropping programme for the coming season another matter which should be given consideration is the fact that the production

of high-yielding mangel, carrot, potato, and lucerne crops is made easier and more profitable if these crops are given the advantage not only of high fertility, but also of freedom from weeds. Often relatively high fertility may be secured by breaking up old pasture for these crops. Further, in respect to weeds, old pasture often possesses superiority, provided it is treated properly, and this even though the surface layer be heavily infested with weeds and weed-seeds. From the weed viewpoint, two deep ploughings which are at times recommended for the preparation of a seed-bed from old pastures constitute just one deep ploughing too many. The first deep ploughing may put most of the weed-seeds at such a depth in the soil that they do not germinate, and hence cause no trouble so long as they are left in that position. But the second deep ploughing will bring them near enough to the surface again to lead to their germination and consequent trouble from them. Fortunately, often the necessary good seed-bed can be obtained without two deep ploughings—a skim ploughing in the winter followed by disking to pulverize the surface soil, and a deep ploughing in the spring may be employed to obtain a sufficiently good seed-bed. It has been pointed out above that this procedure would be unsatisfactory in the case of land infested with twitchy weeds, among which may be included not only twitchy grasses, but also other twitchy plants such as sorrel and yarrow. However, as a rule, the growing of such crops as carrots, potatoes, mangels, and lucerne should not be attempted on land infested with twitchy weeds.

Heavy Acre-yields commonly desirable.

In planning cropping, attention should be given to the fact that the use of more permanent strains of important pasture species, together with appropriate top-dressing, has given during recent times pastures which remain in a satisfactory condition for a longer period, if not permanently. This reduces the amount of land it is desirable to put under the plough annually for the purpose of replacing worn-out pastures. In turn, in many instances this will create a more urgent need than ever for greater yields to the acre in respect to such crops as mangels, chou moellier, roots, and rape. As a rule there will be no decrease in the total tonnage of such crops required, but it will be desirable to grow that tonnage on a smaller area.

The desirability of greater yields to the acre gives importance to the fact that generally in the case of crops that respond well to good treatment greater expenditure is justified on high-priced good land than at first sight might seem to be justified. The amount of increase in the crop decides whether the additional expenditure necessary to obtain the increase is justified. Over many years the results of farmers' crop competitions have demonstrated that in the case of mangels, for instance, differences of from 20 tons to 30 tons an acre, and more, in yield are commonly due to additional manure and labour. An expenditure of £4 an acre would cover the cost of much additional manure and labour, and if it resulted in an increase of 20 tons an acre in yield the cost of the increase in yield would be 4s. a ton. How mangels at this cost compare with other feeds may be gauged from the fact that with oats at 1s. 6d. a bushel, or barley at 2s. 3d. a bushel, or oat-sheaf chaff at £2 10s. a ton, or hay at £2 3s. a ton, or pollard at £4 11s. a ton, then on the basis of their nutritive value mangels are worth from 8s. to 9s. 6d. a ton, according to their composition. Though in practice all the feeds specified are not interchangeable, the statement of their relative nutritive values in terms of cash values provides the basis for instructive comparisons. The important point illustrated by such a relatively low price for the increase in yield of mangels is that crops of heavy yields may readily provide comparatively cheap feed even though the outlay on such crops seems high.

In planning future cropping the incidence of crop diseases and pests in the past at times is of much moment. This is especially so in the case

of crops of the cabbage family, such as rape, turnips, and swedes. Incidentally, chou moellier is very resistant to, though not proof against, club-root, and has successfully followed another crop which has failed because of club-root attack. Potatoes also may become seriously infected through the unpicked tubers of previous diseased crops; and a limited amount of New Zealand experience supports the view that heart-rot in mangels is carried over in the soil from one crop to another. Previous grass-grub infestation should be considered, and, if possible, cereals and pastures infested by the grub should not be followed immediately by similar crops.

Pasture Management.

Normally in June the completion of grassland work commenced earlier calls for attention; part of the harrowing and top-dressing may remain to be done. These operations were discussed in some detail in the March and April notes.

On most farms there are certain grass paddocks which are more suitable than the remaining ones for providing late winter and early spring feed. Usually these are the paddocks which are well drained, supporting a sward containing a considerable amount of rye-grass, and possibly also provided with some shelter. Such paddocks especially should be harrowed if necessary and top-dressed in good time, for, in many districts, if they are shut up about the end of May or early in June they will provide a substantial amount of fresh feed in the latter part of July and in August.

If there is evidence of current infestation by grass-grub, then, when possible, hay and roots should be fed out on the infested areas: the additional stock-trampling and consolidation which results either lessens the activity of the grubs or facilitates the recovery of the injured plants, and the hay may contain viable seeds of valuable pasture species which on germinating tend to repair the ravages of the grubs.

Crop Utilization.

On many farms the pulling and storing of mangels should receive attention in June, particularly if the land occupied by the mangel is required for another crop, such as oats, to be sown soon. However, general rules about the pulling of mangels are unreliable. In certain districts the crops will continue growing in weight well beyond the date fixed by some as that at which pulling should be carried out. It is very doubtful whether it is advisable to pull such crops early in June if they are not to be used until late August or September, unless the land they occupy is specially required for some other crop or likely to become so wet later that it will be difficult to cart the crop off. However, if the crop is to be fed to stock earlier than has been mentioned above, then it should be pulled in good time to allow it to ripen or mature before the stock consume it. Freshly pulled mangels cannot stand frost as well as those still in the ground or those that have been pulled for a few days. Hence, if at all possible, in order to avoid frost injury, broken mild weather should be selected for the work of pulling. Many sheep-farmers successfully utilize mangels relatively late in the season without storing them. If broken-mouthed ewes are available they are put in to eat off the tops; then the roots are harrowed out in breaks some days prior to the sheep being given access to them.

If the mangels are to be pitted, the practice of throwing the roots into small heaps, covering the heaps with leaves removed from the roots, and leaving them for a few days before carting is favoured by some: it is believed that the roots keep better by being left in a heap for upwards of a week before carting into the pit.

Ordinarily it is not advisable to allow stock to fall off much in condition before a commencement is made with the utilization of reserves of

such feed as roots, hay, and silage. It is desirable to plan on the possibility of having to provide for a late severe spring, but such planning should lead to adequate provision being made at the appropriate season, and, at this stage, looking to the future may be carried too far at the expense of the current requirements of the stock.

The winter feeding of stock on roots alone is undesirable. Stock so fed receive a diet which is much too watery and cold for ordinary requirements, and which is likely to set up digestive disturbances. Heavy root feeding is particularly unsuitable for old, toothless ewes if the roots are offered intact. Heavy root feeding to any type of breeding-ewe or to dairy cattle is also inadvisable. Roots may suitably be supplemented with dry fodder such as hay or chaff. The quantities of each class of feed to be used depend to a considerable extent on such circumstances as the supplies available and how much feed the stock can obtain from the pastures on which they may be running. Detailed information applicable to individual cases may be obtained on application to district officers of the Department of Agriculture.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Laying out the Ground for planting.

AFTER the site for the new plantation has been thoroughly drained and cultivated as directed in last month's notes, it should be marked off, and before the holes are dug the position each tree is to occupy indicated by a stake. The question of adequate headlands on which to turn implements, horses, &c., must not be overlooked. It is suggested that a headland of about 20 ft. be left all round the plantation for this purpose. Each tree should be allowed sufficient space for proper development. On rich soil trees of normal stature usually should be planted 20 ft. apart each way, and trees of tall and spreading habit planted 22 ft. apart. On poorer classes of soil plant the trees from 18 ft. to 20 ft. apart.

Cultivation and Manuring.

As soon as possible growers should put in hand the annual ploughing of the orchard, with a view to having the work completed as early as possible in June. The soil in early June should be in reasonably good condition for ploughing. The majority of fruit-trees will have shed their leaves by the end of May or early June and cover crops will have come to the flowering stage. Such manures as superphosphate and sulphate of potash are recommended to be sown just prior to this the deepest ploughing of the season. When turned under in conjunction with the green crop they will be deposited close to the roots of the trees. The freshly ploughed soil will receive the full benefit of the action of the winter frosts. The striking-out furrow should be thrown up against the trees, while the finishing furrow should come midway between the rows of trees. In heavy land the finishing furrow will act as a temporary drain, and if carefully opened up will carry away practically all surface water. When ploughing, care should be taken not to injure the tree-roots more than is necessary, and to eliminate avoidable injury the plough should be set to a depth of about 3 in. for the striking-out furrow and increased to a depth of 6 in. or 7 in. for the finishing furrow.

Planting.

The holes for fruit-trees should be wide enough to permit of the spreading of the roots, and should be convex—*i.e.*, of the shape of an inverted saucer—at the bottom. This shape is obtained by forming a slight

mound with loose surface soil in the bottom of the hole so that when the tree is planted its base stands a little higher than the roots, which should be spread out with a slight downward tendency. A handful of bonedust or superphosphate well worked into the soil of each hole will assist in providing nutriment, thereby ensuring rapid growth of the tree. The tree should be planted firmly, and at about the same depth as it was growing in the nursery—or possibly a little more deeply. The root system is usually damaged when being lifted from the nursery-bed. With a clean sharp pruning-knife or secateurs bruised and damaged roots should be cut back to sound tissue. A clean cut will quickly callus over. With a view to guarding against excessive drying of the roots, only a few trees should be removed from the "heeling-in" bed at a time. The actual planting operation is carried out by placing the tree on the slight mound in the hole —previously mentioned—and obtaining the position of the tree by taking an alignment at different directions on trees already planted or on stakes marking the position of unplanted trees. When the correct position has been found, a small quantity of fine surface soil should be shovelled in and tamped gently round the roots. Each root should be firmly embedded in the soil. It often happens that the roots do not arise from the same level but occur spirally, each of the main roots being an inch or two above the one below, in which case it is very unwise to crowd them all together. When all the roots have been covered over and well tamped, the remainder of the hole may be filled up and the soil trodden firmly round the tree, with the exception of a few final shovelfuls, which should be left untrodden. The pruning should be delayed until the trees are planted. Trees which are merely rods should be headed back to a point about 20 in. from the ground-level. On branched trees two years from the bud it is advisable to select three or four branches equidistantly spaced spirally around the upper portion of the trunk. The selection of branches directly opposite one another should be avoided, as weakly crotches will be formed. Each of the branches retained should be cut back to about the fifth bud from the base; the two topmost buds preferably should be side buds if the branches are of normal vigour, so that the foundation branches may be duplicated and result in strong stocky trees. If it is necessary to retain weakly branches, these should not be duplicated this season, but should be cut to an outside bud, unless the branch is in an almost horizontal position, when an inside bud should be chosen for the top bud. Too-deep planting, insufficient pruning, deficient cultivation, and neglect to control diseases and pests will cause trees to be unthrifty.

Winter Pruning.

In those districts with a temperate climate it is not advisable to prune too early owing to the fact that a warm spell, which sometimes occurs in such districts, has the effect of exciting early pruned trees into premature growth which may be destroyed subsequently by frosts. Generally, however, particularly in large orchards, pruning should be commenced as soon as the trees are dormant, so as to allow sufficient time between the completion of the pruning and the commencement of the new season's growth for the sprays appropriate to be dormant season to be applied. Stone-fruits, being the first to start into growth, should be pruned before pip-fruits.

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus-culture.

If much rain is experienced during the month of April, especially after the dry autumn this year, it will cause citrus trees to produce much young succulent growth, which will not have time to harden before the first frosts occur. In those localities where frosts are prevalent measures should be taken by growers to protect their trees. Details for the protection of the trees and their crops from frost injury were outlined in the *Journal* notes of May last year.

Heavy rains favour the spread and development of citrus brown-rot. To prevent the spread of this disease all branches on infected trees should be removed to a height of 3 ft. from the ground, infected fruits destroyed, and cultivation carried out to maintain a somewhat dry soil-mulch under the trees. Further, a cover crop, which will prevent the upward spread of the zoospores by means of water splashes, should be grown. If the foregoing recommendations are followed, growers should readily eliminate this disease from their orchards.

The time is now approaching when the harvesting of citrus fruits will be receiving attention. Lemons should be harvested as soon as the fruit has attained the necessary size, so as to prevent ripening beyond the silver or pale-yellow colour which is the most suitable stage for curing. Poorman oranges should not be gathered before they are fully matured, but for table use should be harvested while the flesh is tight and compact, so as to secure the maximum juice content.

Sweet oranges should be left on the tree until they are properly matured, so that they may develop their full flavour. Where new plantings are contemplated, the selecting and ordering of trees should be undertaken as early as possible.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Winter Eggs.

As the majority of the mature hens will, by now, have terminated their laying-season and will be undergoing the moulting process, it may be taken for granted that few hens will be profit-makers until the end of winter or the early spring, as it is rare for a bird to lay and moult at the same time. Hence, if eggs are to be secured in good numbers now, the pullet principally must be depended upon to produce them. Having pullets on hand, however, and even those hatched at the desired period for winter laying, does not necessarily mean that a good egg-yield will be secured, as the stock is only one essential requirement. At this period of the year, when natural conditions are all against the birds' laying, it is necessary to give the pullets the best possible attention in order that they may produce to their fullest capacity. This means that, as far as possible, summer conditions must be provided in order that the birds will be in a state of comfort at all times, and thus enjoy a healthy, thriving condition. When unfavourable weather prevails the birds should be kept inside the houses, where they are protected from the rain, cold, and wind. The quarters must be roomy, not merely sufficient for the birds to roost in at night, but with ample space to accommodate them in comfort on a wet day. They must also be provided with an ample supply of good, nourishing food, for the pullet's life is a busy one, since the laying fowl produces a more concentrated and valuable food commodity for its size than any other domesticated animal. It is also essential that exercise be encouraged, and this can be induced most effectively by having the floor covered with litter from 4 in. to 6 in. thick, in which the evening meal and grain is scattered. It is always a good plan to give a little more food at this meal than is required, so that the birds will have something to scratch for in the early morning and thus obtain the necessary exercise.

With regard to diet, there are many different rations that will produce good egg-yields. The main object is to see that the food is of good quality and fed in abundance. It is very inadvisable to feed musty or damaged grain because it is cheap. A frequent mistake is to think that all grain is alike, and that cheap defective wheat and low-grade oats, barley, &c.,

are economical. The food-value of these is almost invariably in direct proportion to their cost, and it is generally the case that the best grades of grain materials are the cheapest in the long run, for, given all the greenstuff and meat required, the bird will be satisfied with a much smaller proportion of good-quality grain than it will with a cheap grade. The waste, also, is considerably less with the better-quality article. Cheap grain for poultry is false economy in the worst form, and quality rather than quantity should always be the deciding factor in a ration for the layer, especially where the winter-laying pullet is concerned. Many complaints have reached the writer regarding pullets bred to lay during the winter which have gone into a moult with a consequent poor egg-supply. This undesirable moult may be due to several causes, such as insufficient or inferior food, change in the system of feeding, contracting colds, as well as the common cause—change of quarters.

The Fertile Egg.

The question has been asked whether it is not a sure sign, when an egg is broken into a saucer and a watery coloured substance is to be seen adhering to the edge of the yolk, that the egg had been fertilized. The substance referred to is called the cholaze and can be seen in all eggs whether fertile or infertile. The cholaze extends from the yolk through the white toward each end of the egg in twisted cord-like coils. The cords may be likened to hammock-strings, in that they serve to hold in position the yolk, which is contained in a membrane of delicate construction, and yet allow it to turn freely. The chicken does not come from the cholaze, as is generally supposed, but from the germinal disk, and this is found in the yolk of all eggs whether the hens which produced them have had the society of a male bird or not. The germ disk is circular in shape and about $\frac{1}{8}$ in. in diameter. It varies in colour from light yellow to orange. The difference between a fertilized and an infertilized egg is to be found only in this small disk, which can be seen readily with the naked eye when an egg is broken into a saucer. Of course, when an egg is broken into a saucer, the germ disk will be found as often on the under side as on the top of the yolk.

Egg Classes at Shows.

The great weakness in the egg trade to-day, especially where the eggs come from mixed farmers, is the manner in which they are marketed. The careless way in which many eggs are despatched to the consumer—*i.e.*, in a dirty state and in all sizes and conditions—is not only sufficient to prejudice the consuming public against eggs, but means a direct loss to producers, who cannot expect anything but second- and third-grade prices for such unpresentable commodities. It is generally the case that the person who is careless about the appearance of his eggs is also careless regarding their internal condition. Some poultry societies in the Dominion endeavour by competition and demonstration at shows to educate producers in regard to the class of egg that should be sent to market and the one most desirable for the export trade. An extension of such displays made at our agricultural and pastoral shows would prove a valuable object-lesson, particularly to those who require the lesson most—*i.e.*, the farming community. Sometimes classes are provided for eggs at agricultural and pastoral shows, but too often the dozen largest eggs secures the chief honours quite irrespective of their being uniform in shape and of a good internal quality. Under such conditions, in the country-show class for a dozen eggs, one only requires to save up the double-yolked eggs, however stale they may be, to secure the award. Egg classes at shows will never serve the best purpose until the eggs are judged in accordance with standard requirements, and the competitors, as well as the judges, are familiar with the requirements of this standard, whereby the eggs must not only conform

to a desired size, but to a high degree of cleanliness, colour, bloom of shell, and whereby uniformity of shape must be considered, together with the colour of the yolk and the size of the air-cell, this being an indication of age.

Hereunder is the recognized New Zealand standard of excellence by which egg classes in shows can be judged :—

	Points.
Size of air-cell, almost nominal	40
Weight of eggs (2 oz. standard)	20
Texture of shell (smooth and thick throughout)	15
Colour of yolk (deep orange)	5
Consistency of albumen (not watery)	5
Uniformity	5
Shape	5
Clean shells (natural bloom desired)	5
Total points	100

Serious Defects.—Blood spots and stains, cloudy yolks, developed germs, adhesion of yolks to shell, malformations.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Winter Precautions.

BEFORE the cold weather sets in every hive should be examined in order to make sure that the frames are completely covered with sufficient dry well-fitting mats to keep the bees protected. Wherever a damp or mouldy mat is discovered it should be replaced with a dry one, and the roof examined and repaired. No draughts should be allowed around the frames. Mats made of corn-sacks cut to the exact size of a zinc queen-excluder answer all requirements of warmth. Steps should be taken to ensure that they are placed in their exact position. If placed crookedly the edges are apt to be pushed out between the hive-body and the roof, and will in time absorb enough moisture to make them damp and unwholesome.

Once more the time approaches when the necessity for shelter should impress itself on the beekeeper. It is most essential that the bees be protected from cold winds during the winter. Should no permanent shelter be available, something temporary should be erected if the bees are expected to prove in normal condition in the spring. Manuka scrub is excellent for making a temporary wind-break.

Weeds and grass should be kept down. A good clearing round the hives in autumn will suffice until spring, and will add materially to the comfort of the bees and the well-being of the hives. Not only should the entrances be cleared, but the ground all round the hives similarly treated, and the weeds raked up and destroyed.

Care of Hives.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from the ground to the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring that the hives have a free current of air beneath the bottom-boards and are thus more likely to keep dry. The bottom-boards should never be resting on the ground, or they will rot in very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

Apart from disease, there is no worse feature in an apiary than the presence of leaky hive-covers. A roof which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should cover them either with zinc, ruberoid, or some other water-proof material. If economy must be practised he may cover with cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective water-proofing, and one which anybody can apply.

Plans for Next Season.

During the off-season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are crying out for room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and, while the bees are in a dormant condition, study the best methods of improving his stocks. Neither weather conditions, locality, nor any other factor will influence the honey crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these be in existence during the following summer.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Some Notes on Pruning.

TREES, shrubs, and climbers frequently fail in the many objects for which they are grown through the neglect of pruning. The results vary according to the kind or variety of the subject, but to obtain straight timber, a close even shelter-hedge, regular heavy fruit crops easily gathered, &c., growth must generally be more or less directed and controlled by pruning.

It is most important that attention should be given for the first few years after planting, as neglect at that period often leads to results that are most difficult if not impossible to correct satisfactorily later. Coniferous plants are to some extent an exception, as they usually follow a naturally simple and satisfactory plan of growth with a single central leader. Sometimes one finds a conifer with a strong branch competing in growth with the leader and spoiling the balance of the tree: its complete removal at an early stage is generally advisable. Plants of the coniferous class, used for shelter belts and hedges, are naturally well furnished with branches about the base, when exposed to the light, and require no

"topping" until the desired height is attained. By planting them rather closely together in the line, according to the richness of the soil, the height can often be restricted so that little or no topping is necessary at any time.

In the same way such popular deciduous shelter-trees as poplar and silver birch may often have their growth regulated to suit the circumstances. When these trees are planted with evergreen hedge plants, strong competitive branches which they may have should be removed completely and the leading growth topped to a bud on the weather side to invigorate the plant and hasten development: this will keep them well ahead of the evergreen growth below.

Escallonias and other shrubby hedge-plants, on the other hand, when allowed to grow up without much topping, as is frequently done with a view to quick development, are thin and bare about the base just where the shelter is most required. To make them stool out and form a rather broad and well furnished base they should be cut hard back after planting, and annually for a few years afterwards. This may slightly delay the full development, but will provide efficient shelter of good appearance.

Bush fruits, such as gooseberries and red currants, must be carefully trained along approved lines and receive annual pruning attention at this season if they are to be kept in profitable condition. They are of a vigorous constitution and quickly become overgrown and woody if neglected. They should be trained with one stem from the ground into a well-spaced bush with an open centre. In the case of matured bushes the laterals on the red currant should be spurred back, and the gooseberries should have the laterals which have borne fruit cut down to the base bud. Weak laterals of last season's growth may be treated in the same way, as they are unlikely to be fruitful. Superfluous wood, especially suckers, should be removed completely. This leaves the best of the young wood for cropping during the coming season. The black currant is of quite a different habit: a moist soil and somewhat shaded conditions provide a congenial environment, so that an open centre in the bush is unnecessary. All that is required is to obtain vigorous annual growth, as it is that which produces the best fruit. Young plants should be headed "hard back" to encourage growth, and in older plants the wood that has borne should be cut similarly to a point just above a bud. As suckers are fruitful they should not be suppressed.

With other sundry fruits and nuts the same principles apply: by cutting a young plant to carefully selected wood buds a tree or bush of approved design is built up quickly, having strong well-placed branches without crowding. Such early training is all-important, as when it is well done the plant may always be brought back into a profitable state even after a period of neglect.

The removal of large limbs from mature trees should be done with special care: they should be cut just beyond a lateral growth or close up to the branch or trunk from which they have sprung. An upward cut with the saw must be made in the limb some inches beyond the final cut, which is made afterwards by sawing downwards at a carefully selected angle. In some instances the work should be duplicated by severing the limb as described some distance from the final cut, and, when it is clear, removing the stump by the same method. Paint or tar should be applied to the wound, which will then heal quickly without risk of decay.

Maintaining Fertility in the Soil.

With land in good heart and the necessary shelter provided, sowing and planting may be done with confidence that the crop will generally be good and vary only with the weather conditions experienced. The

main point is to keep the soil in a fertile state: a good judgment of soil conditions, and how they may be best amended, is the greater part of the knowledge required for successful cropping.

A good new loam carefully broken in to destroy all weeds will usually carry good crops for a few years with little trouble and small expenditure on chemical fertilizers. But new land that may be rich but has been water-logged to some extent and had to be drained will take time to become aerated and release the plant-foods it contains. In doing this an application of lime may be of assistance, finely ground limestone or air-slaked burnt lime being harrowed in after winter ploughing or digging, so that it will have ample time to counteract acidity, and by making the stiff soil more friable so making plant-food available as well as improving drainage.

Where new land is composed very largely of sand or clay, the possibilities are there if, water and drainage being provided, the fertility of the soil is built up by providing humus. This, too, will take time, as not until the organic matter incorporated in the soil is assimilated is it available to the plant; and as the capacity for assimilation is more or less limited it sometimes takes years to build up a black, light, rich soil from such beginnings. Materials that may be used for this purpose are seaweed, farm and stable manure, or almost any kind of vegetation that will decay quickly. This vegetation may be grown as a cover crop, such as oats, barley, mustard, peas, beans, or vetches, and turned under where grown, or it may be cut and carted on to the land for turning under. Seaweed is not by any means the least useful for the purpose: for sandy lands in the vicinity of the coast nothing better could be used. Where large quantities are available the cost of carting is the only limit to its use.

However good the land may be originally, or however well it may have been built up into a fertile state, cultivation and cropping use up the supply of humus, and crops become very small and the soil harsh, often with a tendency to set hard unless the supply is maintained. This happens most quickly in a light soil, which is for that reason called hungry, as compared with a retentive heavy soil, where leaching and oxidation are much slower. To maintain fertility, supplies of humus are dug in during the winter, annually, with few exceptions.

The addition of such elements as nitrogen, phosphorus, and potash, in concentrated form, in which they are known as chemical or artificial fertilizers, is also made then or later, as may be most suited to the crop in view. Where humus is supplied in sufficient quantities phosphates are usually the most important fertilizers in demand by crops: they may be supplied now by turning in such slow-acting forms as basic slag or finely ground bonedust and supplementing it shortly before planting or sowing with moderate dressings of superphosphate, which is to a great extent water-soluble and immediately available. Potash is often required in light soils, and may be applied now in the form of kainit, which has the additional advantage of destroying slugs, which are so troublesome during the spring amongst young seedlings. Finely ground copper sulphate, 18 lb. per acre, mixed with the kainit will improve the dressing as a slugicide; copper sulphate in any form is most effective in destroying this pest. Potash is also useful to balance up the effect of heavy dressings of nitrates, which may easily be injurious otherwise. During the growing-season it is best applied as sulphate of potash. Wood ashes stored in a dry place are also rich in potash. Humus generally contains sufficient quantities of nitrogen for the present. Nitrogen, however, can often be applied to crops which require forcing in early spring before the temperatures are sufficiently high for nitrifying bacteria to become active. Nitrate of soda is usually the best form for light soils, and sulphate of ammonia for heavy soils, and as they are liable to be lost by leaching these expensive

fertilizers are applied in small quantities from time to time as required. Soot which has been stored for a few months under dry conditions is also a valuable nitrogenous fertilizer with useful effects as an insecticide: it may be used freely for these purposes at almost any season.

The Tomato Crop under Glass.

When the seedlings have the first pair of true leaves developing, they should be pricked off into boxes filled with soil composed of a good fresh loam with sufficient well-rotted manure to supply humus and sand to keep it open. The plants should be set about 2½ in. apart each way. It is advisable to place them in the ground about up to the seed-leaves, firm the soil about the roots, but avoid carefully the least injury to the stem. The boxes should then be returned to the propagating-house or hotbed, and on the following day when the plants have straightened watered with tepid water through a fine rose. They should be watered again only when it is plainly necessary, and then with tepid water. It is advisable to ventilate freely whenever temperatures permit. Grown in this way with an average temperature of 55° F. a steady, sturdy growth will be obtained, and the plants set out later will grow without receiving a check which so seriously interferes with cropping.

Towards the end of June, where final planting out is done in July, the soil in the house should be thoroughly watered in preparation for planting. In many houses where the soil has been allowed to get dry probably two applications will be necessary: not only the top soil but the subsoil should be thoroughly wet, so that at planting-time the ground will be sufficiently warm and moist for the plants to grow unchecked with little more watering before the warm weather arrives.

The Homestead Garden.

The above remarks on pruning have an important application in this section. Trees and shrubs sometimes show a tendency to straggling or erratic growth, which should be checked by pruning at this season so that the vigour of the plant may be evenly distributed. There is a good deal of art as well as science in carrying out these operations, which should be done only after fully considering the circumstances of each subject. A branch may generally be completely eliminated by severing it close up to its point of origin, or invigorated by cutting new growth back to wood buds, or brought into flower and fruit and growth steadied by summer pruning. The reactions will vary with plants of different kinds, but a very great number of plants are amenable to such treatment. Many kinds of shrubs flower on the young wood, and a crop of wood of good quality must be obtained annually to provide a display: this is done by cutting the wood back to a base bud after it has flowered. A rule with hardly any exception is to avoid a crowded condition of limbs or laterals in any part of the tree or shrub: light is the first requirement of any green plant in all its parts above ground.

Young hardwood plants require careful pruning after setting them out. In some cases they require cutting back to make them stool out; in others the bushy growth is too crowded and has to be cut away, leaving three or four well-selected branches which are shortened to buds that will make well-balanced growth. Most kinds of conifers, heaths, and rhododendrons are exceptions, and require little pruning at this stage.

—W. C. Hyde, Horticulturist, Wellington.

On page 237 of the April *Journal* the amounts of brown-top seed exported to the United States and to Australia are given as 560 tons and 160 tons respectively, whereas the amounts actually exported were 56 tons and 16 tons respectively; the amount of red clover exported to the United Kingdom given as 750 tons was 75 tons, and that exported to Australia, given as 836 tons, was 83 tons.

WEATHER RECORDS: APRIL, 1934.

Dominion Meteorological Office.

NOTES FOR APRIL.

APRIL was a mild month with comparatively little stormy weather. Precipitation was again considerably below normal over the greater part of the Dominion, but after the first nine days rather humid and cloudy conditions prevailed and some good general rains were recorded. Towards the end of the month the ground was gradually becoming saturated, and the effects of the long period of dry weather seemed to be disappearing. Though the weather was not warm or sunny enough to cause vigorous growth of vegetation, a certain amount took place in all districts, and the situation as regards feed for stock is generally quite good.

Rainfall.—Heavy rains occurred in the high parts of Taranaki and the western and central portions of the South Island. Elsewhere totals were once more considerably below normal. The east coast of the North Island had a particularly dry month.

Temperatures.—As already indicated, for most of the country the month was a mild one, with temperatures above normal. In parts of the eastern districts of the South Island the excess amounted to over two degrees. In Hawke's Bay, however, where there was a prevalence of southerly winds, the position was exactly reversed. The Wellington Province also recorded mean temperatures which were on the cold side. The absence of very strong cold winds prevented serious ill effects from such low temperatures as were experienced. There were some cold nights just before the middle of the month, and on the 13th widespread frosts occurred. On the 27th there was a sharp fall of temperature, marking the first touch of winter. So far there has been little snowfall, but from the 25th the ranges had a fair coating.

Sunshine. — Less than the average amount of bright sunshine was recorded in most districts, but Nelson 197·3 hours, New Plymouth 191·0 hours, and Blenheim 187·6 hours, fared well, and the southern part of the South Island had slightly more than the average.

Pressure Systems.—At the beginning of the month pressure was above normal over a very large area extending from South Australia to beyond the Chatham Islands and from 25° to 55° south latitude. On the 1st the highest pressure was over Foveaux Strait and reached about 30·6 in. The centre of the anticyclone moved very slowly northwards and eastwards without reduction of pressure. Though barometers fell considerably on the 9th, there was a tendency for high pressure throughout the month.

Between the 8th and the 11th widespread rains occurred during the passage of a rather vigorous westerly depression. Some very heavy falls were recorded on the west coast and the main ranges in the South Island.

The next storm was a rather complex one, and affected some part of the country on each day from the 14th to the 18th. On the 16th and 17th rain was almost general, the west coast again recording heavy falls. Northerly gales blew in many places on the 17th.

The most general rains were associated with a third storm system which slowly crossed the Dominion between the 21st and 25th. This also was responsible for very heavy falls in western districts and the ranges of the South Island. There were northerly gales on the 23rd. Snow fell on the ranges on the 24th and 25th, and many hailstorms were reported. The depression was followed by a decided fall of temperature.

RAINFALL FOR APRIL, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.	Total for Year to Date.	Average for Year to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	2·85	12	0·88	4·42	10·59	14·96
Russell	4·09	15	1·26	4·25	12·68	13·77
Whangarei	2·27	17	0·64	4·93	12·04	17·18
Auckland	3·33	18	0·97	3·54	14·73	12·40
Hamilton	2·13	10	0·44	3·85	9·56	14·09
Rotorua	2·60	12	0·80	4·47	13·84	15·91
Kawhia	4·57	11	1·36	4·65	16·76	14·48
New Plymouth ..	5·32	13	1·29	4·60	15·68	16·30
Riversdale, Inglewood ..	9·89	13	3·07	8·11	23·71	28·69
Whangamomona ..	12·15	9	2·34	6·52	19·88	20·97
Hawera	2·69	6	1·30	3·48	12·49	12·40
Tairua	5·37	15	1·71	5·96	15·80	19·51
Tauranga	4·34	16	0·95	4·77	17·33	16·34
Maraehako Station, Opotiki	3·55	11	1·15	4·74	12·92	16·43
Gisborne	1·01	6	0·60	4·05	8·78	14·65
Taupo	2·21	9	0·58	3·60	13·50	12·85
Napier	1·28	7	0·53	2·78	12·14	11·62
Hastings	0·95	7	0·52	3·33	9·89	10·27
Whakarara Station ..	1·65	9	0·55	..	17·96	..
Taihape	1·76	7	1·05	2·79	10·82	10·79
Masterton	..	..	..	3·05	..	11·19
Patea	1·80	6	0·96	3·67	12·99	13·01
Wanganui	2·54	5	1·08	3·27	14·22	10·99
Foxton	2·25	7	0·94	2·50	10·61	8·69
Wellington	3·50	9	1·16	3·53	11·48	12·12
			South Island.			
Westport	9·08	15	1·80	8·25	34·53	29·30
Greymouth	10·31	17	1·84	8·48	29·79	32·66
Hokitika	14·57	15	3·11	9·33	32·53	36·23
Ross	17·58	14	5·21	12·18	42·74	44·21
Arthur's Pass	22·06	12	5·78	15·42	51·13	52·63
Okuru, South Westland	..	..	..	14·12	..	50·52
Collingwood	8·99	13	2·28	8·15	20·93	25·81
Nelson	2·91	11	0·70	3·11	9·17	11·46
Spring Creek, Blenheim	1·73	8	0·75	2·12	5·20	8·50
Hanmer Springs ..	1·77	9	0·67	3·32	20·64	13·62
Highfield, Waiau ..	1·72	10	0·58	2·60	14·69	11·02
Gore Bay	1·01	8	0·34	2·38	15·99	9·77
Christchurch	1·13	8	0·76	1·86	7·88	7·76
Timaru	1·36	11	0·32	1·59	12·15	7·90
Lambrook Station, Fairlie	..	..	..	1·97	..	8·55
Benmore Station, Clearburn	2·83	13	0·87	2·40	8·85	9·20
Oamaru	1·21	12	0·32	1·79	8·38	7·40
Queenstown	3·71	13	1·08	2·98	10·22	10·45
Clyde	3·59	11	1·35	1·45	9·20	5·85
Dunedin	2·17	16	0·36	2·77	12·49	11·87
Wendon	..	..	..	2·71	..	10·91
Gore	3·71	..	..	3·12	..	12·10
Invercargill	3·43	19	0·60	4·14	13·79	15·14
Puysegur Point ..	6·05	18	0·99	7·67	22·91	29·00
Half-moon Bay ..	3·53	19	0·52	5·10	14·06	19·37

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FERTILIZING INFLUENCE OF LEGUMES.

A. D. M., Waipawa :—

Does a leguminous crop growing in association with a non-leguminous one impart any of its nitrogen to the latter crop whilst both crops are growing ? If not, when does the nitrogen become available ? Would it be beneficial or necessary to sow a nitrogenous manure with a crop of oats and peas sown together for ensilage ?

The Fields Division :—

There is only scant definite information on the point, but what there is suggests that a leguminous crop supplies nitrogen to a companion non-leguminous annual crop. There is much conclusive evidence that a leguminous crop benefits in respect to nitrogen an annual crop which occupies the same ground the next season. In the case of pasture where the decay of clover roots may be taking place, nitrogen from the clover does assist the growth of grasses growing in association. Under ordinary conditions it is neither necessary nor beneficial to apply a nitrogenous fertilizer with a mixed crop of oats and peas.

FEEDING OF LUPINS TO SHEEP.

A. D. M., Waipawa :—

What is the procedure to follow when grazing sheep on lupin. The sheep will be ewes in lamb. I am led to understand that lupin is poisonous under certain circumstances. Could it be grazed for short periods daily ? Could it be used as a sole diet for a short period ? At what stage of growth is grazing commenced ?

The Fields Division :—

Experience of grazing lupins in this Dominion is very limited and confined principally to Canterbury. So far as present experience goes, annual blue lupin cannot be claimed to be as palatable to sheep as most other crops, but when sown with either grass or rape kale the sheep learn to acquire a taste for it. It may be fed in a green stage, but it appears to be preferable to feed it when the earliest pods are yellow to brown, when both the foliage and pods are more readily eaten. Ewes in lamb must not be chased about when feeding on lupin, nor should very hungry sheep be turned on it, as there is a tendency to develop staggers, but no serious mortality has been reported and no trouble has been associated with careful handling. There appears to be no necessity to feed for short periods daily, but a run off into a grass paddock is preferred. On the other hand, lupins can be fed for lengthy periods of a month to six weeks at least, provided sheep get used to it gradually.

CONTROL OF " WILD SHAMROCK."

T. W., Westport :—

I have in the garden a small bulb called " wild shamrock " or " four o'clock," and have tried to exterminate it by sieving the soil, but this method does not meet with any success as the bulbs are more plentiful than ever. This bulb flowers in January and February, and when dug up at this time of the year has about twenty or thirty smaller bulbs attached. Would you inform me if there is any method of extermination ?

The Horticulture Division :—

If the " wild shamrock " is growing in the flower-garden the land may be planted in shrubs which will overgrow the weed, or it may be laid down in grass, in which case the weed will be smothered out. If it is growing in the vegetable-garden trenching the weed in deeply is the best way of getting rid of it.